FLOW OF LIQUID FUEL THROUGH ORIFICES

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AN INVESTIGATION OF THE FLOW OF LIQUID FUEL THROUGH ORIFICES

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PART 1.

Object.

AN INVESTIGATION OF THE FLOW OF LIQUID FUEL THROUGH ORIFICES.

The object of this thesis is the investigation of the flow of liquid fuel through orifices.

The fuel used throughout the investigation was kerosine oil. No attempts were made to conduct any test with any other oils, although the apparatus used and the system of calculation can easily be applied to any other fuel, such as alcohol, gasoline, agni-benzol or others.

In the testing of engines it is very desireable to know just how much fuel it is burning at any instant. At present the general method of determining fuel consumption in an engine is to measure the time and determine the weight of fuel used during that time, or to measure the fuel and determine the time. In either case there is much chance for error

because the running conditions may vary during the course of the run. An indicating device which would register any instantaneous change in flow would be the solution of the problem. With this perfected the cause of varition could be discovered and the best running conditions of the engine could be determined. An instrument of this kind would, therefore, be of much value.

With this idea in view, an attempt was made to build and calibrate an instrument or metering device which would register the required readings. A flow meter, the front elevation of which is shown in Fig.I. was the instrument constructed.

PART II.

Apparatus.

The apparatus is as follows:- a 5 gallon tank of kerosine which has a pipe leading from its lower end into a carburetor D, Fig.I., 2 feet below. The float in D maintains the oil at a constant level so that the flow into the apparatus always is under one constant head. From here the oil flows through the pipe N, and through the orifices A and B into the carburetor E. From here the oil flows through the orifice C and out into a measuring glass.

The center line of the horizontal pipe leading to the carburetor E is 2.3 inches above the center line of the outlet pipe which holds the orifice C.

The so called orifices are standard pet-cocks. They have the regular opening and closing levers, and can be opened full amount or any fraction thereof. Flat pieces of brass were fastened under the control handle, and ordinary protractors were soldered onto these brass plates. The plan view of the apparatus

as shown Fig.II., shows how the protractors were connected.

An indicating pointer was attached to handle of the valve or orifice. By means of this pointer and protractor the opening and closing position of the orifice was determined. This was done by allowing the fuel to flow through the system. With two valves open the third handle was turned along the indicator until no fuel flowed out of C. This point was then marked as the closing position of orifice. The indicator showed the angle on protractor at this point.

The positions or angles of the opening and closing are given as follows for each orifice:-

	A	B	C
Closed at	47 deg.	138 deg.	127deg.
Opened 1 deg. at	46 deg.	139 deg.	126deg.

This means that when the indicator is over the angle indicated in the first row, the orifice A, B or C is just the closed position.

The second row shows the indicator position when the orifice is one degree open.

Fig.III. shows a section through the carburetors used in this apparatus. They are standard pieces, and can be replaced at any time. The fuel enters through the pipe at the lower right hand side, raises in tube F, and leaves at the lower left. These carburetors maintain a constant level of the fuel.

The center line through the pipe C was called the zero line. About 8 inches up from this line and leading out from the pipe N at right angles is a brass tube. Attached to this tube is one of glass which turns at right angles and goes straight up. This glass tube shows at all times what the level of the fuel is in the carburetor D.This also shows the head on the system at all times. It should be and is constant throughout all runs.

Half way between the two orifices A and B is a tube which leads up. About four inches up on this tube another tube leads off at right

angles. These tubes show at any instant what the head is above orifice B. Either the column F or G will show at any instant what this head is in inches of the fuel used in the test. The tube F is bent at an angle at top so that more accurate readings can be taken. When the column falls below the 19 inch line, the column G is read instead of F. This gives the same readings as column F.

Another tube is set up in the line between the carburetor E and the orifice C. This tube represents the head in the line just after the carburetor E and is called column H.

The whole apparatus is mounted on a wooden frame.

Utilizing the center line of C as a zero line, there is a scale graduated in inches set up on the frame under the column H, G, L and F. By means of this scale the heights of the fuel in these various columns can be read, and, therefore, the heads at any instant can be read at the various points in the line.

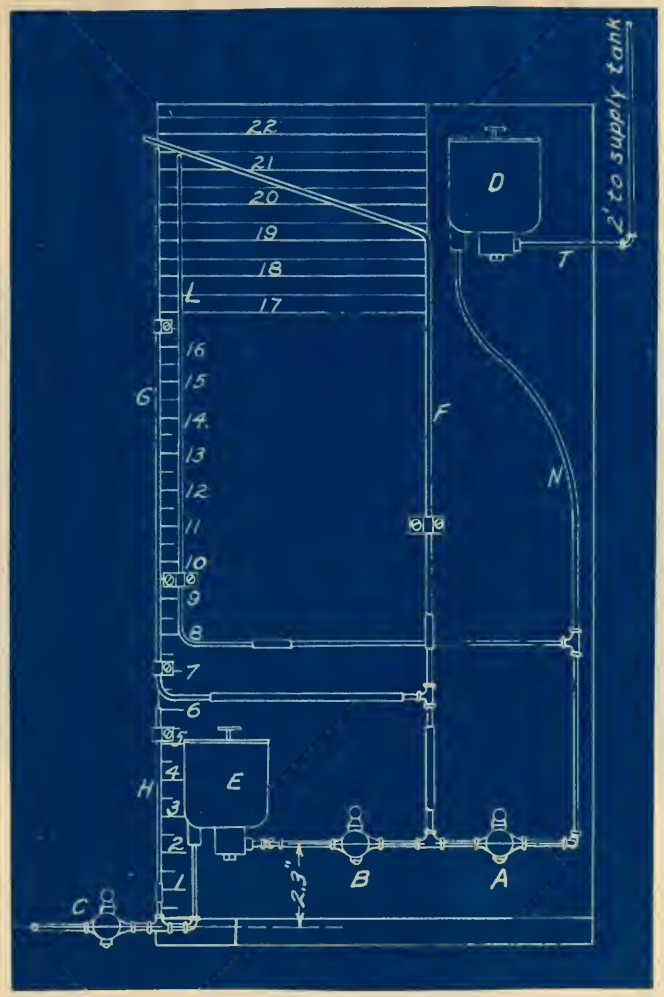
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Fig.1,

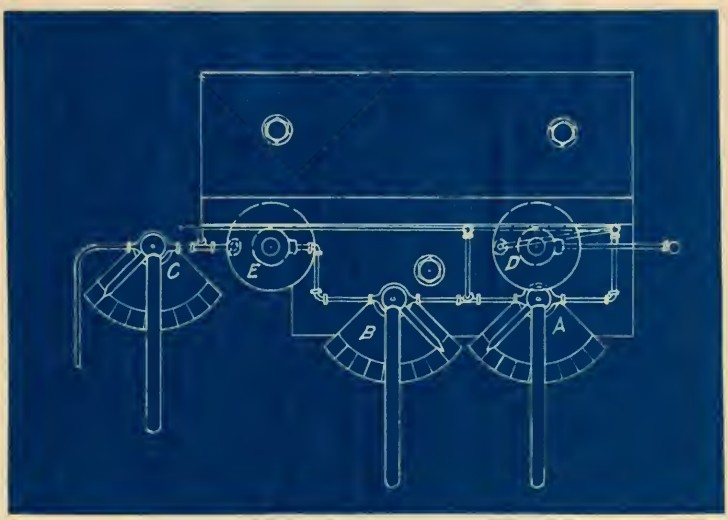


Fig. 11.

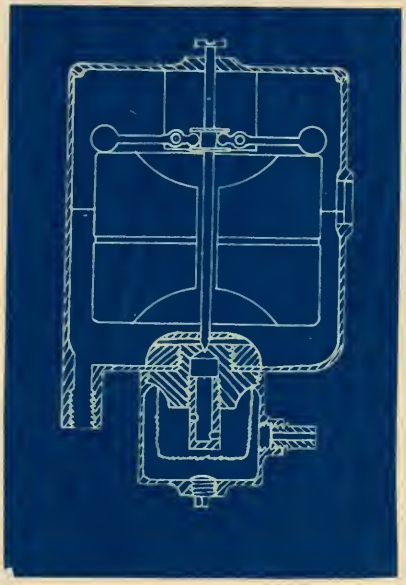


Fig. 111.

PART 111.

Proceedure.

The first step in conducting the test of this instrument was to determine the closing position of the orifices. The method of doing this was described in Part I. under apparatus. It was found that the largest opening of orifice A is 47 degrees. For orifice B it was found to be 36 degrees. For orifice C it was found to be 32 degrees. This means that these are the number of degrees on the protractor indicated by the pointer between the largest opening position and closing position for each orifice.

Runs were made with the orifices opened to various degrees on the protractors. The first test was made with the orifice A opened 47 degrees and B opened 36 degrees. The opening of orifice C was varied by four degree increments from the closed postion to the position of the largest. opening. This gives nine separate runs. The runs were of two minute duration and the fuel was measured in cubic centimeters at the end of each run.

When this test was completed, runs were

made with A open 47 degrees and B open 32 degrees. The next test was made with A open 47 degrees and B open 28 degrees. This was continued until B was closed. A was then closed to 43 degrees and the same process was gone through. During each separate run the orifice C was varied four degrees, from 32 degrees open to closed. In these tests there were 12 different positions of the orifice A, 9 positions of the orifice B, for every position of A, and 8 positions of orifice for every position of B. This totals up to 8 x 9 x 12 or 864 runs.

The readings taken for each run were as follows:-

Degrees opening of A.

Degrees opening of B.

Degrees opening of C.

Height of column F or G.

Height of column L.

Height of column H.

Number of cubic centimeters of fuel which flowed through the orifice.

The temperature of the oil.

A Baumé reading was taken the first day that runs were made, and the specific gravity calculated for each run.

PART IV.

Calculations.

The following formula was used to calculate the specific gravity of the oil for the various temperatures.

$$\text{Specific gravity} = \frac{141.5}{131.5 + \text{deg. Baumé}}$$

60 degrees Fahrenheit, standard.

Degrees Baumé vary one degree Baumé for every ten degrees Fahrenheit change in temperature.

Example:

At 71.5 degrees Fahrenheit the Baumé was 43.2 degrees.

$$\text{Sp. gr. at 71.5 deg. Fahr.} = \frac{141.5}{131.5 + 43.2}$$

$$= .80996$$

At 60 degrees Fahrenheit the Baumé reading is $43.2 - \frac{71.5 - 60}{10} = 42.05$

$$\text{The sp.gr. is } \frac{141.5}{131.5 + 42.05} = .81562$$

To calculate the pounds of kerosene per hour, the following method was used.

$$\text{Lb./hr.} = \frac{\text{sp.gr.} \times .002203 \times \text{C.C.} \times 60}{T}$$

.002203 = the weight, in pounds of one C.C. of water.

C.C. = the cubic centimeters of kerosene which flowed in the time T.

T = the time of flow in minutes.

For two minute runs the formula reduces to:-

$$\text{Lb./hr.} = \frac{\text{sp.gr.} \times .002203 \times \text{C.C.} \times 60}{2}$$

$$= 0.06609 \times \text{C.C.} \times \text{sp. gr.}$$

PART V.

An Automatic Weighing and Recording Device.

The large figure in the back cover shows a very accurate and convenient apparatus for weighing a definite amount of fuel; the watch shown, automatically recording the time of flow. This apparatus was built in the electrical laboratory of Armour Institute, and operates as follows;-

Running, no testing.

Switch to Right.

As gasoline is used, tank gets lighter and rises- this makes rear contact and opens supply valve. Tank will fill until it drops and breaks contact. This stops gasoline supply. The tank now gets lighter as gasoline is being used- then operation repeats.

Testing.

Switch to Left.

Now supply valve always remains closed. As fuel is used, tank gets lighter and raises- this makes front contact and starts the watch. Move the switch to the off postion. Put one-half pound weight under tank- put switch on

testing position (to left again). The tank will now rise when the one-half pound of gasoline has been used. This makes front contact the second time and stops the watch. Take the reading and turn the switch to the right and remove the one-half pound test weight.

PART VI.

Data and Curves.

Figures 1 to 12 are drawn with H constant for each curve.

With a given opening of valves A, B and C, the height of column F can be found by referring to proper curve.

Example.

Given C= 20 deg. open.

" A= 43 deg. "

" B= 28 deg. "

From Fig. 2., curve III. F is found to be 19.7 inches.

Figures 13 to 24 are drawn with H constant for each curve.

Knowing the postion of valves A and B and the height of column F, we can go to curves 13 to 24 and determine the pounds oil flowing per hour.

Example.

Given F = 20 inches.

" A = 43 degrees open.

" B = 28 degrees open.

From figure 14, curve III. ,it is found

that 24 pounds of kerosine flow per hour.

Figures 25 to 34 are drawn with F constant for each curve.

With a given opening of valves A and B and the height of column F, we can go to the curves and find the number of pounds of kerosine which are flowing per hour.

Example.

Given F = 19 inches.

" B = 28 deg. open.

" A = 30 deg. open.

From figure 27, curve IV., it is found that 32.5 pounds of kerosine flow per hour.

Figures 34 is drawn with B constant for each curve.

Knowing the height of column F and the position of A, and B is open 36 degrees, we can refer to the figure and find the number of pounds of fuel which flow per hour.

Example.

Given F = 24 inches.

" A = 15 deg. open.

Given B = 36 deg. open.

From figure 34, curve IX., it is found that 20 pounds of kerosine flow per hour.

Figure 35 is figure 34 drawn to a larger scale. The points for F = 17 were taken directly from figure 34.

Table 1.

"A" open 47 deg. 76 deg. Fahr.
"B" open 36 deg. 5 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.50	0	0.00
4	20.85	20.79	4.42	108	2.33
8	20.82	20.74	4.39	301	6.50
12	20.79	20.55	4.30	535	11.54
16	20.72	20.20	4.20	893	19.25
20	20.50	19.70	3.90	1300	28.00
24	20.30	19.05	3.60	1734	37.40
28	20.05	18.30	3.20	2190	47.30
32	19.80	17.70	2.50	2520	54.40

Table 2.

"A" open 47 deg. 74 deg. Fahr.
"B" open 32 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.80	----	43	2.32
8	20.80	20.66	----	118	6.37
12	-----	20.40	4.40	214	11.54
16	-----	20.20	----	354	19.10
20	20.52	19.65	3.95	519	28.00
24	-----	19.00	----	702	37.90
28	-----	18.20	3.35	870	46.90
32	19.00	17.10	----	920	49.60

Table 3.

"A" open 47 deg. 74 deg. Fahr.
"B" open 28 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	29.90	29.90	4.70	0	0.00
4	-----	20.79	----	42	2.26
8	-----	20.70	----	125	6.75
12	-----	20.48	----	214	11.54
16	20.70	20.35	4.20	349	18.80
20	-----	19.70	----	513	27.65
24	20.35	19.06	3.54	693	37.40
28	-----	18.38	----	866	46.70
32	19.98	18.24	----	918	49.56

Table 4.

"A" open 47 deg. 74 deg. Fahr.
"B" open 24 deg. 2min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.70	0	0.00
4	-----	20.76	----	42	2.66
8	-----	20.66	----	118	6.27
12	20.74	20.46	4.33	216	11.64
16	-----	20.20	----	353	19.05
20	20.55	19.70	3.90	514	27.70
24	-----	19.10	----	695	37.50
28	-----	18.68	2.60	816	44.00
32	20.10	19.64	----	799	43.10

Table 5.

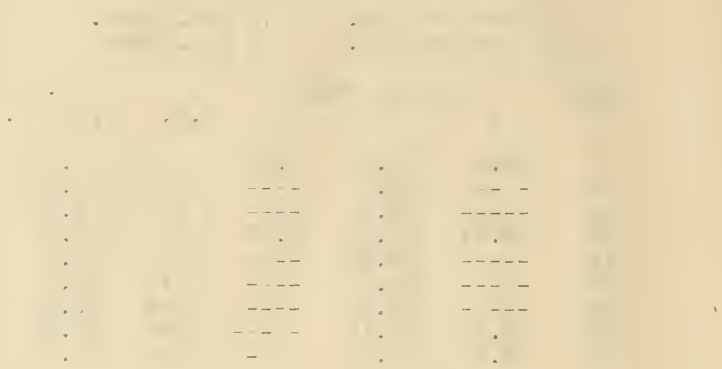
"A" open 47 deg. 74 deg. Fahr.
"B" open 20 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.70	0	0.00
4	-----	20.78	----	42	2.26
8	-----	20.66	----	114	6.15
12	20.74	20.50	4.38	215	11.60
16	-----	20.30	----	352	19.00
20	-----	19.70	----	514	27.70
24	-----	19.15	----	676	36.40
28	20.30	19.15	-----	694	37.40
32	20.30	19.15	----	660	35.60

Table 6.

"A" open 47 deg. 74 deg. Fahr.
"B" open 16 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.70	0	0.00
4	-----	20.78	----	43	2.32
8	-----	20.66	----	117	6.32
12	20.74	20.48	4.32	213	11.50
16	-----	20.30	----	345	18.60
20	-----	19.70	----	510	27.50
24	-----	19.68	----	548	29.60
28	20.50	19.68	----	524	28.30
32	-----	19.68	----	509	27.50



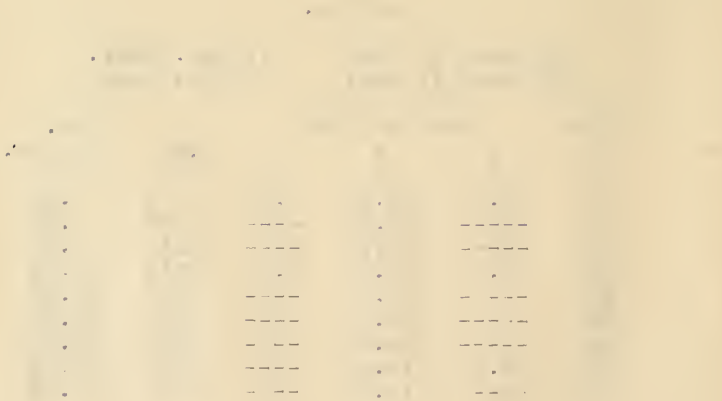


Table 7.

"A" open 47 deg. 74 deg. Fahr.
"B" open 12 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.70	0	0.00
4	-----	20.75	----	45	2.42
8	-----	20.65	----	119	6.42
12	20.70	20.48	4.35	212	11.45
16	-----	20.30	----	348	18.75
20	20.70	20.19	----	386	20.80
24	20.70	20.19	----	355	19.15
28	20.70	20.19	----	355	19.15
32	20.70	20.19	----	355	19.15

Table 8.

"A" open 47 deg. 74 deg. Fahr.
"B" open 8 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.70	0	0.00
4	-----	20.75	----	44	2.38
8	20.80	20.63	4.40	119	6.42
12	-----	20.52	----	205	11.05
16	20.75	20.50	----	200	10.80
20	20.75	20.50	----	185	10.00
24	20.75	20.50	----	185	10.00
28	20.75	20.50	----	185	10.00
32	20.75	20.50	----	185	10.00

Table 9.

"A" open 47 deg. 75 deg. Fahr.
"B" open 4 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.63	0	0.00
4	-----	20.78	----	44	2.38
8	-----	20.70	----	72	3.88
12	20.80	20.70	----	73	3.93
16	20.80	20.70	----	72	3.88
20	20.80	20.70	-----	72	3.88
24	20.80	20.70	----	72	3.88
28	20.80	20.70	----	72	3.88
32	20.80	20.70	----	72	3.88

Table 10.

"A" open 43 deg. 75 deg. Fahr.
"B" open 36 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.70	0	0.00
4	-----	20.75	4.60	45	2.43
8	-----	20.60	----	119	6.43
12	20.70	20.43	4.40	215	11.60
16	-----	20.20	----	358	19.35
20	-----	19.68	----	516	27.90
24	20.80	19.04	3.60	692	37.40
28	-----	18.15	3.18	870	47.00
32	-----	17.95	----	908	49.00

Table 11.

"A" open 43 deg. 79 deg. Fahr.
"B" open 32 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.80	----	43	2.30
8	-----	20.70	----	115	6.14
12	-----	20.43	4.30	230	12.28
16	20.70	20.30	----	351	18.75
20	-----	19.78	----	520	27.80
24	-----	19.06	----	708	37.80
28	-----	18.78	----	837	44.70
32	20.14	18.78	----	798	42.60

Table 12.

"A" open 43 deg. 79 deg. Fahr.
"B" open 28 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.78	----	44	2.35
8	-----	20.68	----	119	6.36
12	-----	20.47	----	225	12.00
16	20.50	20.28	4.20	359	19.15
20	-----	19.80	----	522	27.90
24	20.30	19.15	3.58	692	37.00
28	20.25	19.00	----	812	43.35
32	20.25	19.00	----	705	37.65

Table 13.

"A" open 43 deg. 79 deg. Fahr.
"B" open 24 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.79	----	44	2.35
8	-----	20.64	----	118	6.30
12	20.76	20.48	4.38	220	11.75
16	-----	20.28	----	360	19.40
20	20.50	19.65	3.78	564	30.10
24	-----	19.30	----	709	37.90
28	20.38	19.30	----	695	37.10
32	20.38	19.30	----	638	34.10

Table 14.

"A" open 43 deg. 79 deg. Fahr.
"B" open 20 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.79	----	44	2.35
8	-----	20.70	----	116	6.20
12	-----	20.49	----	233	12.43
16	-----	20.35	----	354	18.90
20	-----	19.78	----	516	27.55
24	20.47	19.63	2.90	638	34.10
28	-----	19.63	----	573	30.60
32	20.47	19.63	----	562	30.00

Table 15.

"A" open 43 deg. 79 deg. Fahr.
"B" open 16 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.78	----	45	2.40
8	-----	20.70	----	119	6.36
12	20.70	20.50	4.30	234	12.50
16	-----	20.29	----	366	19.55
20	-----	20.00	----	478	25.50
24	20.60	20.00	----	458	24.45
28	-----	20.00	----	438	23.40
32	20.60	20.00	----	442	23.60

Table 16.

"A" open 43 deg. 79 deg. Fahr.
"B" open 12 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.78	----	45	2.40
8	-----	20.68	----	118	6.30
12	20.70	20.57	4.38	232	12.40
16	20.70	20.36	----	335	17.90
20	20.70	20.36	----	346	18.47
24	20.70	20.36	----	316	16.88
28	20.70	20.36	----	314	16.75
32	20.70	20.36	----	315	16.85

Table 17

"A" open 43 deg. 79 deg. Fahr.
"B" open 8 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.79	----	45	2.40
8	-----	20.68	----	116	6.20
12	20.76	20.58	4.20	230	12.28
16	20.76	20.58	----	229	12.20
20	20.76	20.58	----	182	9.73
24	20.76	20.58	----	182	9.73
28	20.76	20.58	----	182	9.73
32	20.76	20.58	----	182	9.73

Table 18

"A" open 43 deg. 79 deg. Fahr.
"B" open 4 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.78	----	46	2.46
8	-----	20.74	3.80	114	6.09
12	20.80	20.74	----	90	4.80
16	-----	20.74	----	67	3.58
20	20.80	20.74	----	66	3.52
24	20.80	20.74	----	66	3.52
28	20.80	20.74	----	66	3.52
32	20.80	20.74	----	66	3.52

Table 19

"A" open 39 deg. 75 deg. Fahr.
"B" open 36 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lbs. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.78	----	44	2.38
8	-----	20.67	----	121	6.54
12	20.77	20.45	4.40	215	11.60
16	-----	20.15	----	355	19.20
20	-----	19.65	----	527	28.50
24	20.20	18.96	3.53	705	38.10
28	15.60	18.00	----	865	46.75
32	14.50	17.90	----	905	48.90

Table 20.

"A" open 39 deg. 71.5 deg. Fahr.
"B" open 32 deg. 2 min runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.79	----	45	2.41
8	-----	20.68	----	116	6.22
12	-----	20.46	----	224	12.00
16	20.74	20.18	4.20	348	18.65
20	-----	19.68	----	517	27.50
24	-----	18.92	----	690	37.00
28	20.20	18.75	2.90	828	44.40
32	-----	18.75	----	766	41.10

Table 21.

"A" open 39 deg. 71.5 Deg. Fahr.
"B" open 28 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.78	----	44	2.36
8	-----	20.70	----	117	6.28
12	20.76	20.46	4.36	226	12.10
16	-----	20.24	----	352	18.90
20	------	19.70	----	520	27.90
24	20.32	19.00	3.48	690	37.00
28	-----	18.90	----	780	41.80
32	-----	18.90	----	699	37.50

Table 22.

"A" open 39 deg. 71.5 Deg. Fahr.
"B" open 24 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.79	----	44	2.36
8	-----	20.69	----	117	6.28
12	-----	20.50	----	225	12.05
16	-----	20.20	----	359	19.25
20	-----	19.70	----	518	27.80
24	20.40	19.24	3.40	670	35.90
28	-----	19.20	----	677	36.30
32	-----	19.25	----	644	34.50

Table 23.

"A" open 39 deg. 71.5 Deg.Fahr.
"B" open 20 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.80	----	45	2.41
8	-----	20.68	----	116	6.22
12	-----	20.44	----	224	12.00
16	20.70	20.25	4.17	361	19.35
20	------	19.75	----	513	27.50
24	-----	19.56	----	590	31.65
28	20.50	19.56	----	560	30.00
32	-----	19.56	-----	546	29.30

Table 24.

"A" open 39 deg. 71.5 Deg. Fahr.
"B" open 16 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.79	----	45	2.41
8	-----	20.69	-----	117	6.28
12	-----	20.55	----	224	12.00
16	-----	20.35	----	360	19.30
20	-----	19.98	-----	488	26.20
24	20.60	19.98	----	477	25.60
28	-----	19.98	-----	448	24.00
32	-----	19.98	----	436	23.35

Table 25.

"A" open 39 deg. 71.5 Deg. Fahr.
"B" open 12 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.79	----	44	2.47
8	-----	20.69	----	113	6.07
12	-----	20.50	----	220	11.08
16	20.70	20.35	----	254	13.60
20	20.70	20.35	----	256	13.70
24	20.70	20.35	----	319	17.10
28	20.70	20.35	----	319	17.10
32	20.70	20.35	----	319	17.10

Table 26.

"A" open 39 deg. 71.5 Deg. Fahr.
"B" open 8 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.80	----	45	2.41
8	-----	20.67	----	118	6.34
12	20.75	20.58	4.00	206	11.05
16	20.75	20.58	----	237	12.70
20	20.75	20.58	----	194	10.40
24	20.75	20.58	----	172	9.23
28	20.75	20.58	----	172	9.23
32	20.75	20.58	----	172	9.23

Table 27.

"A" open 39 deg. 71.5 Deg. Fahr.
"B" open 4 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.78	----	43	2.31
8	20.83	20.78	-----	108	5.80
12	20.83	20.78	----	88	4.73
16	20.83	20.78	----	64	3.43
20	20.83	20.78	----	64	3.43
24	20.83	20.78	----	64	3.43
28	20.83	20.78	----	64	3.43
32	20.83	20.78	----	64	3.43

Table 28.

"A" open 35 deg. 71.5 Deg. Fahr.
"B" open 36 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.76	----	43	2.31
8	20.70	20.65	4.40	119	6.43
12	-----	20.45	----	215	11.60
16	-----	20.15	----	350	18.90
20	20.54	19.60	3.90	525	28.40
24	-----	18.85	----	705	38.10
28	20.05	18.00	3.00	865	46.75
32	-----	17.90	----	910	49.80

Table 29.

"A" open 35 deg. 71.5 Deg Fahr.
"B" open 32 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.78	----	45	2.41
8	-----	20.68	----	124	6.66
12	-----	20.50	----	210	11.27
16	20.70	20.15	4.20	350	18.80
20	-----	19.57	----	521	27.95
24	-----	19.26	----	672	36.10
28	20.40	19.20	----	660	35.40
32	20.40	19.20	----	622	33.40

Table 30.

"A" open 35 deg. 71.5 Deg. Fahr.
"B" open 28 deg. 2 Min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.78	----	45	4.41
8	-----	20.68	----	124	6.66
12	-----	20.50	----	210	11.27
16	20.70	20.15	4.20	350	18.80
20	-----	19.57	----	521	27.95
24	-----	19.26	----	672	36.10
28	20.40	19.20	----	660	35.40
32	20.40	19.20	----	622	33.40

Table 31.

"A" open 35 deg. 71.5 Deg. Fahr.
"B" open 24 deg. 2 min.runs

Valve	Head of fuel				Lb.
C	L	F	H	C.C.	per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.79	----	44	2.36
8	-----	20.68	----	119	6.43
12	20.78	20.50	4.37	212	11.40
16	-----	20.20	----	362	19.40
20	-----	19.67	----	510	27.40
24	20.48	19.40	----	646	34.65
28	20.48	19.40	----	582	31.20
32	20.48	19.40	----	576	30.90

Table 32.

"A" open 35 deg. 71.5 Deg. Fahr.
"B" open 20 deg. 2 min. runs

Valve	Head of fuel				Lb.
C	L	F	H	C.C.	per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.78	----	45	2.41
8	-----	20.68	----	116	6.22
12	20.79	20.52	4.38	212	11.40
16	-----	20.23	----	357	29.90
20	20.55	19.78	-----	503	27.00
24	20.55	19.70	----	560	30.00
28	20.55	19.70	-----	517	27.75
32	20.55	19.70	----	500	26.80

Table 33.

"A" open 35 deg. 71.5 Deg. Fahr.
"B" open 16 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb per Hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.78	----	45	2.41
8	-----	20.66	----	117	6.28
12	-----	20.52	----	234	12.55
16	20.70	20.28	4.10	352	18.90
20	20.65	20.05	3.30	490	26.30
24	20.65	20.05	----	420	22.55
28	20.65	20.05	----	420	22.55
32	20.65	20.05	----	420	22.55

Table 34.

"A" open 35 deg. 71.5 deg. Fahr.
"B" open 12 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.79	----	45	2.41
8	-----	20.68	----	115	6.17
12	20.75	20.50	4.30	237	12.70
16	20.75	20.40	----	450	24.15
20	20.75	20.40	----	340	18.25
24	20.75	20.40	----	310	16.65
28	20.75	20.40	----	300	16.10
32	20.75	20.40	----	300	16.10

Table 35.

"A" open 35 deg. 71.5 Deg. Fahr.
"B" open 8 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.79	----	46	2.47
8	20.80	20.65	----	114	6.12
12	20.80	20.65	4.00	213	11.43
16	20.80	20.65	----	228	12.23
20	20.80	20.65	----	184	9.89
24	20.80	20.65	----	172	9.24
28	20.80	20.65	----	172	9.24
32	20.80	20.65	----	172	9.24

Table 36.

"A" open 35 deg. 71.5 Deg. Fahr.
"B" open 4 deg. 2 min runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	20.85	20.82	4.00	40	2.14
8	20.85	20.82	----	98	5.26
12	20.85	20.82	-----	67	3.60
16	20.85	20.82	----	64	3.44
20	20.85	20.82	----	64	3.44
24	20.85	20.82	-----	64	3.44
28	20.85	20.82	----	64	3.44
32	20.85	20.82	----	64	3.44

Table 37.

"A" open 31 deg. 71.5 deg. Fahr.
"B" open 36 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.77	----	45	2.41
8	-----	20.66	----	120	6.49
12	20.73	20.47	4.40	210	11.35
16	-----	20.10	----	355	19.20
20	-----	19.30	----	525	28.40
24	-----	18.35	----	710	38.40
28	20.10	17.55	2.80	830	44.85
32	-----	17.53	----	840	45.40

Table 38.

"A" open 31 deg. 71.5 deg. Fahr.
"B" open 32 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.79	----	44	2.36
8	-----	20.60	----	114	6.12
12	-----	20.46	----	212	11.40
16	20.70	20.14	4.20	352	18.90
20	-----	19.40	-----	520	27.90
24	20.42	18.90	----	696	37.30
28	20.42	18.90	----	634	34.05
32	20.42	18.90	----	610	32.75

Table 39.

"A" open 31 deg. 71.5 Deg. Fahr.
"B" open 28 deg. 2 Min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.78	----	45	2.41
8	-----	20.70	----	118	6.34
12	20.80	20.50	4.38	217	11.65
16	-----	20.11	----	352	18.90
20	-----	19.42	----	515	27.65
24	20.48	19.18	-----	652	35.00
28	20.48	19.18	----	594	31.90
32	20.48	19.18	----	566	30.40

Table 40.

"A" open 31 deg. 71.5 Deg Fahr.
"B" open 24 deg. 2 Min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.79	----	45	2.41
8	-----	20.74	----	118	6.34
12	-----	20.50	----	230	12.35
16	20.72	20.10	4.15	352	18.90
20	-----	19.43	----	520	27.90
24	20.55	19.35	----	592	31.80
28	20.55	19.35	----	546	29.30
32	20.55	19.35	----	526	28.20

Table 41.

"A" open 31 deg. 71.5 Deg.Fahr.
"B" open 20 deg. 2 Min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.77	----	44	2.36
8	-----	20.72	----	115	6.17
12	-----	20.53	----	214	11.50
16	-----	20.11	----	360	19.30
20	20.60	19.69	3.65	508	27.30
24	20.60	19.69	----	505	27.10
28	20.60	19.69	----	464	24.90
32	20.60	19.69	----	464	24.90

Table 42.

"A" open 31 deg. 71.5 Deg. Fahr.
"B" open 16 deg. 2 Min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.78	----	45	2.41
8	-----	20.70	----	116	6.22
12	20.75	20.50	4.38	214	11.50
16	-----	20.10	----	350	18.80
20	20.70	20.00	----	460	24.70
24	20.70	20.00	----	388	20.80
28	20.70	20.00	----	384	20.60
32	20.70	20.00	----	384	20.60

Table 43.

"A" open 31 deg. 71.5 deg. Fahr.
"B" open 12 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.79	----	45	2.41
8	-----	20.72	----	115	6.17
12	20.78	20.40	4.40	218	11.70
16	20.78	20.38	----	322	17.30
20	20.78	20.38	----	290	15.55
24	20.78	20.38	----	285	15.30
28	20.78	20.38	----	285	15.30
32	20.78	20.38	----	285	15.30

Table 44.

"A" open 31 deg. 71.5 deg. Fahr.
"B" open 8 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0.	0.00
4	-----	20.80	----	45	2.41
8	-----	20.70	----	117	6.28
12	20.80	20.60	4.10	214	11.50
16	20.80	20.60	----	244	12.00
20	20.80	20.60	----	180	9.67
24	20.80	20.60	----	162	8.70
28	20.80	20.60	-----	162	8.70
32	20.80	20.60	----	162	8.70

Table 45.

"A" open 31 deg. 71.5 deg. Fahr.
"B" open 4 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	20.86	20.86	4.50	42	2.25
8	20.86	20.80	4.20	64	3.44
12	20.86	20.80	----	70	2.76
16	20.86	20.80	----	70	2.76
20	20.86	20.80	----	70	2.76
24	20.86	20.80	----	70	2.76
28	20.86	20.80	----	70	2.76
32	20.86	20.80	----	70	2.76

Table 46.

"A" open 27 deg. 71.5 deg. Fahr.
"B" open 36 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.77	----	144	2.38
8	-----	20.65	----	121	6.54
12	20.72	20.45	4.40	210	11.35
16	-----	19.75	----	355	19.20
20	-----	18.70	----	527	28.50
24	20.33	17.33	3.50	685	37.05
28	-----	16.65	----	805	43.50
32	-----	16.65	----	765	41.35

Table 47.

"A" open 27 deg. 71.5 deg. Fahr.
"B" open 32 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.79	----	45	2.41
8	-----	20.66	----	120	6.49
12	-----	20.40	----	214	11.50
16	-----	19.33	----	357	19.15
20	20.50	18.84	3.80	519	27.90
24	20.50	18.54	----	610	32.70
28	20.50	18.54	----	559	30.00
32	20.50	18.54	----	540	29.00

Table 48.

"A" open 27 deg. 71.5 deg. Fahr.
"B" open 28 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.78	----	44	2.36
8	-----	20.65	----	116	6.22
12	-----	20.32	----	214	11.50
16	-----	19.80	----	352	18.90
20	20.54	18.90	3.80	520	27.90
24	20.54	18.81	----	586	31.40
28	20.54	18.81	----	517	27.75
32	20.54	18.81	----	510	27.40

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[illegible]

[illegible]

Table 49.

"A" open 27 deg. 71.5 deg. Fahr.
"B" open 24 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.79	----	45	2.41
8	-----	20.67	----	118	6.34
12	-----	20.43	----	227	12.20
16	20.70	19.80	4.20	360	19.30
20	-----	19.15	----	499	26.80
24	20.60	19.07	----	538	28.90
28	20.60	19.10	----	462	24.80
32	20.60	19.20	----	462	24.80

Table 50.

"A" open 27 deg. 71.5 deg. Fahr.
"B" open 20 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.79	----	45	2.41
8	-----	20.68	----	117	6.28
12	20.81	20.37	4.32	228	12.75
16	-----	19.80	----	347	18.60
20	-----	19.42	----	496	26.60
24	-----	19.48	----	426	22.85
28	20.68	19.50	----	416	22.30
32	20.68	19.52	----	410	22.00

Table 51.

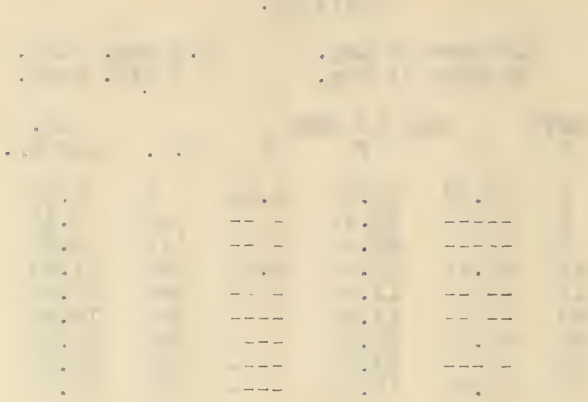
"A" open 27 deg. 71.5 deg. Fahr.
"B" open 16 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.79	----	45	2.41
8	-----	20.69	----	116	6.22
12	20.75	20.40	4.31	220	11.80
16	-----	19.95	----	345	18.50
20	-----	19.88	----	352	18.90
24	20.70	19.88	----	350	18.80
28	-----	19.88	----	350	18.80
32	20.70	19.88	----	350	18.80

Table 52.

"A" open 27 deg. 71.5 deg. Fahr.
"B" open 12 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.80	----	44	2.38
8	-----	20.70	----	116	6.20
12	-----	20.40	----	222	11.90
16	20.78	20.22	3.50	348	18.70
20	20.78	20.22	----	279	14.95
24	20.78	20.22	-----	264	14.15
28	20.78	20.22	----	260	13.95
32	20.78	20.22	----	260	13.95



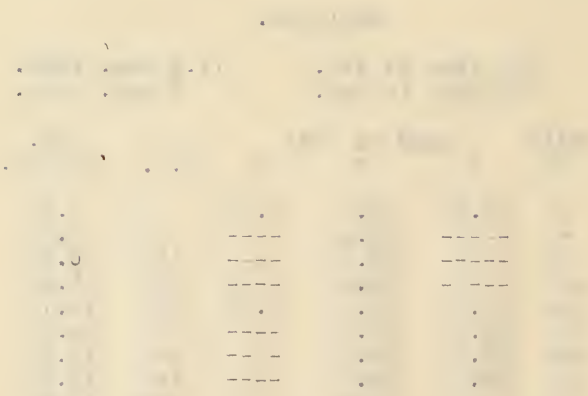


Table 53.

"A" open 27 deg. 71.5 deg. Fahf.
"B" open 8 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.81	----	44	2.38
8	-----	20.6E	----	115	6.17
12	20.80	20.51	3.80	209	11.200
16	20.80	20.51	----	209	11.20
20	20.80	20.51	----	162	8.70
24	20;80	20.51	----	162	8.70
28	20.80	20.51	----	162	8.70
32	20.80	20.51	----	162	8.70

Table 54.

"A" open 27 deg. 71.5 deg. Fahr.
"B" open 4 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.79	----	43	2.30
8	20.85	20.79	3.70	108	5.80
12	20.85	20.79	----	80	4.30
16	20.85	20.79	----	64	3.44
20	20.85	20.79	----	64	3.44
24	20.85	20.79	----	64	3.44
28	20.85	20.79	----	64	3.44
32	20.85	20.79	----	64	3.44

Table 55.

"A" open 23 deg. 71.5 deg. Fahr.
"B" open 36 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.75	----	45	2.41
8	-----	20.51	----	122	6.60
12	20.70	20.15	4.30	215	11.60
16	-----	19.20	----	350	18.90
20	20.53	17.50	3.90	524	28.30
24	-----	15.35	3.45	688	37.15
28	20.30	15.15	----	726	39.20
32	20.30	15.15	----	680	36.70

Table 56.

"A" open 23 deg. 71.5 deg. Fahr.
"B" open 32 deg. 2 min. runs.

Valve C	head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.79	----	45	2.40
8	-----	20.60	----	115	6.17
12	-----	20.15	----	211	11.30
16	-----	19.21	----	356	19.10
20	20.60	18.32	3.32	496	26.60
24	-----	18.35	----	468	25.10
28	-----	18.35	----	461	24.20
32	-----	18;35	----	446	23.90

Table 57.

"A" open 23 deg. 71.5 deg. Fahr.
"B" open 28 deg. 2 min. runs.

Valve	Head of fuel				Lb.
G	L	F	H	C.C.	per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.78	----	44	2.38
8	20.82	20.60	4.40	117	6.28
12	-----	20.18	----	232	12,45
16	20.70	19.27	4.10	360	19.30
20	-----	18.51	----	496	26.60
24	20.63	18.48	----	454	24.40
28	-----	18.48	----	454	24.40
32	20.63	18.48	----	454	24.40

Table 58.

"A" open 23 deg. 71.5 deg. Fahr.
"B" open 24 deg. 2 min. runs.

Valve	Head of fuel				Lb.
Cq	L	F	H	C.C.	per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.78	----	44	2.38
8	-----	20.61	4.40	118	6.34
12	20.75	20.15	----	214	11.50
16	-----	19.30	4.10	360	19.30
20	20.65	18.85	----	482	25.85
24	-----	18.85	----	422	22.60
28	-----	18.85	----	398	21.35
32	-----	18.85	----	400	21.45

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Table 59.

"A" open 23 deg. 71.5 deg. Fahr.
"B" open 20 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.79	----	44	2.38
8	-----	20.57	4.40	118	6.34
12	20.80	20.20	----	222	11.90
16	-----	19.37	4.10	354	19.00
20	20.70	19.20	----	440	23.60
24	-----	19.20	----	362	19.40
28	-----	19.20	----	362	19.40
32	20.70	19.20	----	362	19.40

Table 60

"A" open 23 deg. 71.5 deg. Fahr.
"B" open 16 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.80	----	44	2.38
8	-----	20.59	----	117	6.28
12	-----	20.12	----	214	11.50
16	20.73	19.60	3.80	352	18,90
20	20.73	19.51	----	360	19.30
24	20.73	19.51	----	320	17.15
28	20.73	19.51	----	320	17.15
32	20.73	19.51	----	320	17.15

Table 61.

"A" open 23 deg. 71.5 deg. Fahr.
"B" open 12 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.78	-----	44	2.38
8	-----	20.58	----	118	6.33
12	20.80	20.10	4.24	215	11.60
16	20.78	20.00	----	320	17.15
20	20.78	20.00	----	252	13.50
24	20.78	20.00	----	252	13.50
28	20.78	20.00	----	252	13.50
32	20.78	20.00	----	252	13.50

Table 62.

"A" open 23 deg. 71.5 deg. Fahr.
"B" open 8 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.600	0	0.00
4	-----	20.80	----	45	2.41
8	20.80	20.58	4.40	118	6.33
12	20.78	20.40	----	222	11.90
16	20.78	20.40	----	189	10.15
20	20.78	20.40	----	158	8.49
24	20.78	20.40	----	158	8.49
28	20.78	20.40	----	158	8.49
32	20.78	20.40	----	158	8.49

Table 63.

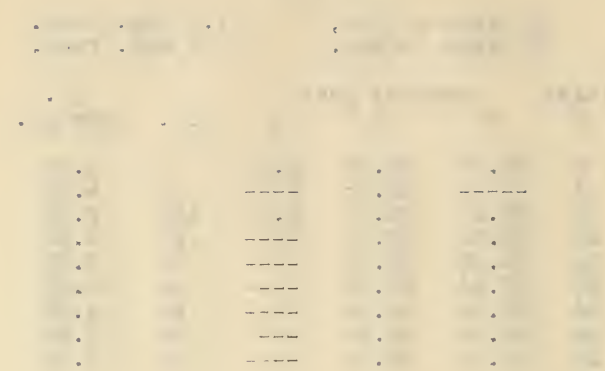
"A" open 23 deg, 71.5 deg. Fahr.
"B" open 4 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	2.25
4	-----	20.78	----	42	6.01
8	20.83	20.78	3.65	112	3.52
12	20.83	20.78	----	66	3.33
16	20.83	20.78	----	62	3.33
20	20.83	20.78	----	62	3.33
24	20.83	20.78	----	62	3.33
28	20.83	20.78	----	62	3.33
32	20.83	20.78	----	62	3.33

Table 64.

"A" open 19 deg. 71.5 deg. Fahr.
"B" open 36 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.78	-----	45	2.43
8	-----	20.42	----	120	6.49
12	20.80	19.65	4.30	218	11.75
16	-----	18.00	3.90	355	19.20
20	20.40	14.80	3.20	514	27.70
24	20.40	12.00	----	660	35.60
28	20.40	12.20	----	645	34.85
32	20.40	12.50	----	620	33.50



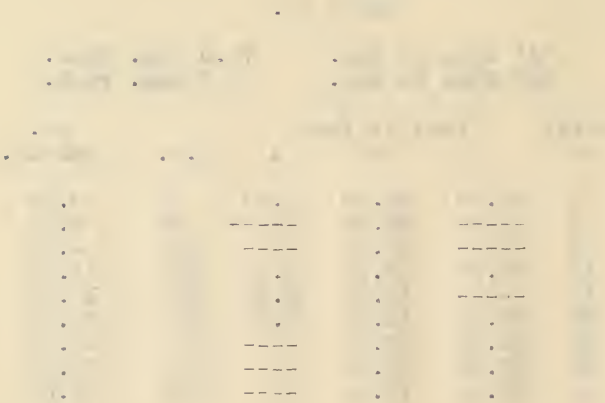


Table 65.

"A" open 19 deg. 71.5 deg. Fahr.
"B" open 32 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.78	-----	44	2.38
8	20.80	20.39	4.40	118	6.33
12	-----	19.62	----	214	11.50
16	20.70	18.20	4.10	368	19.75
20	20.68	17.70	----	426	22.80
24	20.68	17.70	----	378	20.15
28	20.68	17.70	----	378	20.15
32	20.68	17.70	----	378	20.15

Table 66.

"A" open 19 deg. 71.5 deg. Fahr.
"B" open 28 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.77	----	43	2.31
8	-----	20.40	4.40	118	6.33
12	20.75	19.58	----	214	11.50
16	20.70	18.00	4.05	360	19.30
20	-----	17.56	----	450	24.15
24	20.63	17.56	----	386	20.70
28	20.63	17.56	----	386	20.70
32	20.63	17.56	----	386	20.70

Table 67.

"A" open 19 deg. 71.5 deg. Fahr.
"B" open 24 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.78	----	44	2.38
8	-----	20.38	----	119	6.39
12	20.65	19.60	4.30	214	11.50
16	-----	18.03	----	358	19.20
20	20.67	17.65	----	435	23.30
24	20.67	17.65	----	378	20.30
28	20.67	17.65	----	378	20.30
32	20.67	17,65	----	378	20.30

Table 68.

"A" open 19 deg. 71.5 deg. Fahr.
"B" open 20 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.77	----	44	2.38
8	-----	20.39	----	119	6.39
12	-----	19.60	----	230	12.28
16	20.70	18.20	4.00	350	18.90
20	20.68	18.00	----	412	22.10
24	20.68	18.00	----	346	18.55
28	20.68	18.00	----	346	18.55
32	20.68	18.00	----	346	18.55

Table 69.

"A" open 19 deg. 71.5 deg. Fahr.
"B" open 16 deg. 2 min. runs.

Valve	Head of fuel				Lb.
C	L	F	H	C.C.	per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.78	-----	43	2.31
8	-----	20.40	----	118	6.33
12	20.80	19.64	4.35	216	11.60
16	-----	18.65	----	346	18.55
20	20.72	18.54	----	355	19.05
24	-----	18.54	----	304	16.30
28	20.70	18.60	----	302	16.20
32	20.70	18.60	----	302	16.20

Table 70.

"A" open 19 deg. 74 deg. Fahr.
"B" open 12 deg. 2 min. runs.

Valve	Head of fuel				Lb.
C	L	F	H	C.C.	per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.77	----	45	2.40
8	-----	20.40	----	115	6.15
12	20.72	19.52	4.22	226	12.05
16	-----	19.29	----	329	17.60
20	20.72	19.29	----	258	13.80
24	20.72	19.29	----	258	13.80
28	20.72	19.29	----	258	13.80
32	20.72	19.29	----	258	13.80

Table 71.

"A" open 19 deg. 74 deg. Fahr.
"B" open 8 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.77	----	44	2.35
8	20.80	20.40	4.37	117	6.25
12	20.78	20.17	----	217	11.60
16	20.78	20.17	----	181	9.68
20	20.78	20.17	----	158	8.45
24	20.78	20;17	----	146	7.80
28	20.78	20.17	----	146	7.80
32	20.78	20.17	----	146	7.80

Table 72.

"A" open 19 deg. 74 deg. Fahr.
"B" open 4 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.79	----	41	2.19
8	20.82	20.70	----	102	5.45
12	20.82	20.70	----	65	3.47
16	20.82	20.70	----	65	3.47
20	20.82	20.70	----	65	3.47
24	20.82	20.70	----	65	3.47
28	20.82	20.70	----	65	3.47
32	20.82	20.70	----	65	3.47

Table 73.

"A" open 15 deg. 71.5 deg. Fahr.
"B" open 36 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.73	----	44	2.38
8	-----	19.42	----	121	6.54
12	20.80	18.10	4.30	218	11.75
16	20.70	14.60	4.13	350	18.90
20	20.60	10.10	----	493	26.60
24	20.60	10.10	----	475	25.65
28	20.60	10.40	----	460	24.85
32	20.60	10.60	----	450	24.30

Table 74.

"A" open 15 deg. 74 deg. Fahr.
"B" open 32 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.70	----	44	2.35
8	20.79	19.95	4.39	116	6.20
12	-----	18.10	----	222	11.85
16	20.70	15.20	-----	346	18.65
20	20.70	15.10	----	365	19.50
24	20.70	15.35	----	340	18.15
28	20.70	15.50	----	336	17.95
32	20.70	15.60	----	333	17.80

Table 75.

"A" open 15 deg. 74 deg. Fahr.
"B" open 28 deg. 2 min, runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.69	----	44	2.35
8	-----	20.14	----	116	6.20
12	20.70	18.33	4.39	220	11.75
16	20.70	16.20	3.80	338	18.05
20	20.70	16.20	----	336	17.95
24	20.70	16.30	----	316	16.90
28	20.70	16.35	----	308	16.45
32	20.70	16.40	----	298	15.90

Table 76.

"A" open 15 deg. 74 deg. Fahr.
"B" open 24 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.70	----	43	2.30
8	-----	20.00	----	117	6.25
12	20.70	18.50	4.30	214	11.45
16	20.70	16.70	----	346	18.50
20	20.70	16.60	----	327	17.45
24	20.70	16.60	----	294	15.70
28	20.70	16.63	----	294	15.70
32	20.70	16.67	----	294	15.70

Table 77.

"A" open 15 deg. 74 deg. Fahr.
"B" open 20 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.68	----	44	2.35
8	-----	19.97	----	114	6.10
12	20.73	18.00	4.30	216	11.55
16	20.73	17.22	----	333	17.80
20	20.73	17.22	----	292	15.60
24	20.73	17.26	----	268	14.30
28	20.73	17.29	----	268	14.30
32	20.73	17.32	----	268	14.30

Table 78.

"A" open 15 deg. 74 deg. Fahr.
"B" open 16 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.69	----	44	2.35
8	-----	19.92	----	116	6.20
12	-----	18.30	----	224	11.95
16	20.70	17.72	3.35	329	17.60
20	20.70	17.70	----	254	13.55
24	20.70	17.75	----	250	13.35
28	20.70	17.80	----	250	13.35
32	20.70	17.84	----	250	13.35

Table 79.

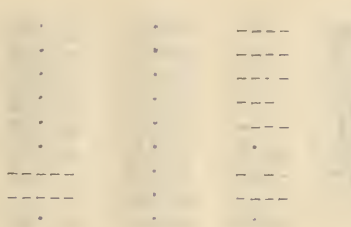
"A" open 15 deg. 74 deg. Fahr.
"B" open 12 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.69	0	0.00
4	-----	20.68	-----	44	2.35
8	-----	20.00	----	117	6.25
12	-----	18.65	----	220	11.75
16	20.70	18.50	----	274	14.65
20	20.70	18.55	----	212	11.30
24	20.70	18.58	----	208	11.10
28	20.70	18.60	----	195	10.40
32	20.70	18.65	----	195	10.40

Table 80.

"A" open 15 deg. 74 deg. Fahr.
"B" open 8 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.69	----	44	2.35
8	-----	19.98	----	117	6.25
12	20.77	19.60	3.80	206	11.00
16	20.77	19.60	----	160	8.55
20	20.77	19.60	----	142	7.59
24	20.77	19.60	----	142	7.59
28	20.77	19.60	----	142	7.59
32	20.77	19.60	----	142	7.59



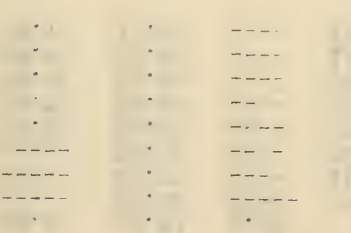


Table 81.

"A" open 15 deg. 74 deg. Fahr.
"B" open 4 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	20.82	20.60	4.20	42	2.24
8	20.82	20.60	----	110	5.87
12	20.82	20.60	----	76	4.06
16	20.82	20.602	----	62	3.31
20	20.82	20.60	----	62	3.31
24	20.82	20.60	----	62	3.31
28	20.82	20.60	----	62	3.31
32	20.82	20.60	----	62	3.31

Table 82.

"A" open 11 deg. 74 deg. Fahr.
"B" open 36 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.48	----	44	2.38
8	20.80	18.66	4.40	121	6.50
12	20.75	14.50	----	216	11.64
16	20.75	8.10	----	337	18.20
20	20.75	7.90q	----	325	17.55
24	20.75	8.10	----	309	16.70
28	20.75	8.20	----	304	16.45
32	20.75	8.30	-----	302	16.30

Table 83.

"A" open 11 deg. 74 deg. Fahr.
"B" open 32 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.48	----	44	2.35
8	20.78	18.63	4.40	122	6.52
12	-----	14.00	----	216	11.55
16	20.70	14.00	----	252	13.45
20	20.70	14.00	----	218	11.65
24	20.70	14.00	----	218	11.65
28	20.70	14.00	----	218	11.65
32	20.70	14.00	----	218	11.65

Table 84.

"A" open 11 deg. 74 deg. Fahr.
"B" open 28 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.49	----	44	2.35
8	20.78	18.63	4.40	115	6.15
12	-----	14.60	----	210	11.20
16	20.70	14.25	----	248	13.25
20	20.70	14.30	----	212	11.30
24	20.70	14.40	----	208	11.10
28	20.70	14.50	----	208	11.10
32	20.70	14.50	----	208	11.10

Table 85.

"A" open 11 deg. 74 deg. Fahr.
"B" open 24 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.50	----	44	2.35
8	-----	18.65	----	115	6.15
12	-----	14.85	----	213	11.40
16	20.72	14.30	----	290	15.50
20	20.72	14.30	----	223	11.90
24	20.72	14.40	----	211	11.25
28	20.72	14.50	----	209	11.15
32	20.72	14.50	----	207	11.05

Table 86.

"A" open 11 deg. 74 deg. Fahr.
"B" open 20 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.49	----	43	2.30
8	20.78	18.60	4.40	115	6.15
12	-----	15.03	----	212	11.30
16	-----	14.71	----	279	14.90
20	-----	14.78	----	204	10.90
24	20.70	14.78	----	204	10.90
28	20.70	14.78	----	204	10.90
32	20.70	14.78	----	204	10.90

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Table 87.

"A" open 11 deg. 74 deg. Fahr.
"B" open 16 deg. 2 min. runs.

Valve	Head of fuel				Lb.
C	L	F	H	C.C.	per hr.
0	20.90	20.90	4.60	0	0.00
4	------	20.48	----	44	2.35
8	-----	18.65	----	116	6.20
12	-----	15.40	----	207	11.05
16	20.70	15.20	----	260	13.90
20	20.70	15.20	----	196	10.45
24	20.70	15.25	----	192	10.25
28	20.70	15.28	----	192	10.25
32	20.70	15.33	----	192	10.25

Table 88

"A" open 11 deg. 74 deg. Fahr.
"B" open 12 deg. 2 min. runs.

Valve	Head of fuel				Lb.
C	L	F	H	C.C.	per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.49	----	43	2.30
8	20.78	18.45	----	116	6.20
12	20.78	16.40	----	228	12.20
16	20.78	16.30	----	220	11.75
20	20.78	16.35	----	177	9.46
24	20.78	16.40	----	173	9.25
28	20.78	16.40	----	170	9.09
32	20.78	16.40	----	170	9.09

Table 89.

"A" open 11 deg. 74 deg. Fahr.
"B" open 8 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.50	----	44	2.35
8	-----	18.66	----	114	10.10
12	20.78	18.15	----	200	7.48
16	20.78	18.12	----	140	6.95
20	20.78	18.12	----	130	6.95
24	20.78	18.12	----	130	6.95
28	20.78	18.12	----	130	6.95
32	20.78	18.12	----	130	6.95

Table 90.

"A" open 11 deg. 74 deg. Fahr.
"B" open 4 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
4	-----	20.25	----	41	2.19
8	20.82	20.25	----	104	5.56
12	20.80	20.25	----	64	3.42
16	20.80	20.25	----	60	3.21
20	20.80	20.25	----	60	3.21
24	20.80	20.25	----	60	3.21
28	20.80	20.25	----	60	3.21
32	20.80	20.25	----	60	3.21

Table 91.

"A" open 7 deg. 71.5 deg. Fahr.
"B" open 36 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.000
2	-----	20.60	----	19	1.020
4	-----	19.40	----	44	2.380
6	-----	17.30	----	76	4.110
8	20.80	12,30	4.35	121	6.540

Table 92.

"A" open 7 deg. 66 deg. Fahr.
"B" open 32deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.000
2	-----	20.59	----	18	0.970
4	-----	19.46	----	44	2.370
6	-----	17.25	----	77	4.150
8	20.78	12.30	4.25	122	6.570

Table 93.

"A" open 7 deg. 66 deg. Fahr.
"B" open 28 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
2	20.85	20.58	4.50	19	1.02
4	*-----	19.45	----	44	2.37
6	-----	17.28	----	76	4.10
8	20.80	12.30	4.35	123	6.53

Table 94.

"A" open 7 deg. 66 deg. Fahr.
"B" open 24 deg. F 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
2	-----	20.58	----	19	1.02
4	-----	19.43	----	44	2.37
6	-----	17.28	----	76	4.10
8	-----	12.28	----	123	6.53

Table 95.

"A" open 7 deg. 66 deg. Fahr.
"B" open 20 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
2	-----	20.57	----	18	0.97
4	-----	19.44	-----	44	2.37
6	-----	17.30	----	77	4.15
8	-----	12.30	----	122	6.57

Table 96.

"A" open 7 deg. 66 deg. Fahr.
"B" open 16 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
2	-----	20.55	----	19	1.02
4	-----	19.46	----	44	2.37
6	-----	17.30	----	77	4.15
8	20.80	12.30	4.35	123	6.55

Table 97.

"A" open 7 deg. 66 deg. Fahr.
"B" open 12 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
2	-----	20.55	----	19	1.02
4	-----	19.50	----	43	2.31
6	-----	17.30	----	77	4.15
8	20.80	12.30	4.35	122	6.57

Table 98

"A" open 7 deg. 66 deg. Fahr.
"B" open 8 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	LB. per hr.
0	20.90	20.90	4.60	0	0.00
2	-----	20.50	----	19	1.02
4	-----	19.47	----	44	2.37
6	-----	16.75	----	78	4.20
8	20.80	12.30	4.35	124	6.68
10	20.75	10.30	----	166	8.95
14	20.75	10.30	----	142	7.65
18	20.75	10.30	----	128	6.90
26	20.75	10.30	-----	128	6.90
32	20.75	10.30	----	128	6.90

Table 99.

"A" open 7 deg. 66 deg. Fahr.
"B" open 4 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.00
2	-----	20.75	----	19	1.02
4	20.85	19.20	4.40	44	2.37
6	20.80	18.10	----	78	4.20
8	20.80	17.90	----	113	6.08
10	20.80	17.90	----	83	4.47
12	20.80	17.90	----	74	3.98
18	20.80	17.90	----	74	3.98
24	20.80	17.90	----	74	3.98
32	20.80	17.90	----	74	3.98

Table 100.

"A" open 3 deg. 66 deg. Fahr.
"B" open 36 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0.00	0.000
1	-----	20.84	----	6	0.324
2	-----	19.92	----	13	0.701
3	-----	13.60	----	31	1.670

Table 101.

"A" open 3 deg. 66 deg. Fahr.
"B" open 32 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0.0	0.000
1	-----	20.84	----	6.0	0.324
2	-----	19.92	-----	13.0	0.701
3	-----	13.60	----	31.5	1.695

Table 102.

"A" open 3 deg. 66 deg. Fahr.
"B" open 28 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0.0	0.000
1	-----	20.84	----	5.5	0.296
2	-----	19.92	----	13.0	0.701
3	-----	13.59	----	31.0	1.670

Table 103.

"A" open 3 deg. 66 deg. Fahr.
"B" open 24 deg... 2 min. runs.

Valve C	Head of feul L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0.0	0.000
1	-----	20.82	----	6.0	0.324
2	-----	19.92	----	13.0	0.701
3	-----	13.60	----	30.5	1.645

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Table 104.

"A" open 3 deg. 66 deg. Fahr.
"B" open 20 deg. 2 min. runs.

Valve	Head of fuel				Lb.
C	L	F	H	C.C.	per hr.
0	20.90	20.90	4.60	0.0	0.000
1	-----	20.85	----	5.5	0.296
2	-----	19.83	----	12.5	0.674
3	-----	13.61	----	31.0	1.670

Table 105.

"A" open 3 deg. 66 deg. Fahr.
"B" open 16 deg. 2 min. runs.

Valve	Head of fuel				Lb.
C	L	F	H	C.C.	per hr.
0	20.90	20.90	4.60	0.0	0.000
1	-----	20.84	----	6.0	0.324
2	-----	19.94	----	13.0	0.701
3	-----	13.60	----	31.0	1.670

Table 106.

"A" open 3 deg. 66 deg. Fahr.
"B" open 12 deg. 2 min. runs.

Valve	Head of fuel				Lb.
C	L	F	H	C.C.	per hr.
0	20.90	20.90	4.60	0.0	0.000
1	-----	20.84	----	6.0	0.324
2	-----	19.92	----	13.0	0.701
3	-----	13.60	----	31.0	1.670

Table 107.

"A" open 3 deg. 66 deg. Fahr.
"B" open 8 deg. 2 min. runs.

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0.0	0.000
1	-----	20.85	----	5.5	0.296
2	-----	19.91	----	13.5	0.728
3	-----	13.58	----	30.5	1.645

Table 108.

"A" open 3 deg. 66 deg. Fahr.
"B" open 4 deg. 2 min. runs

Valve C	Head of fuel L	F	H	C.C.	Lb. per hr.
0	20.90	20.90	4.60	0	0.000
1	-----	20.83	----	6	0.324
2	-----	20.62	----	13	0.701
3	-----	20.35	----	30	1.615
4	-----	19.00	-----	34	1.830
5	-----	12.00	----	40	2.160
6	-----	8.10	----	42	2.260
8	-----	8.10	----	42	2.260
16	-----	8.10	----	42	2.260
32	-----	8.10	----	42	2.260

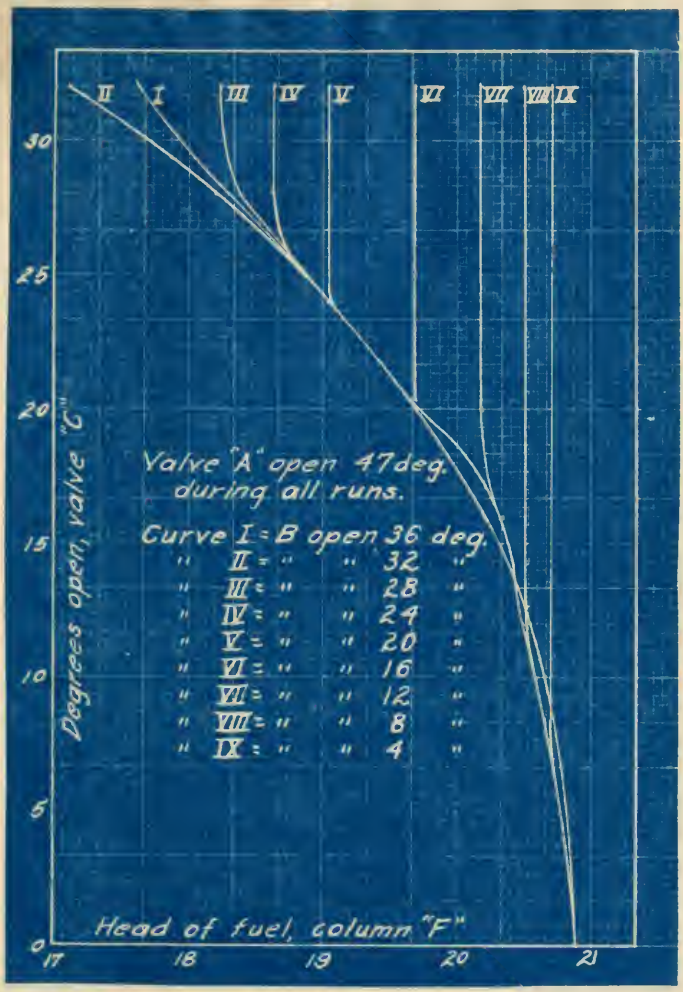

II
I
III
IV
V
VI
VII
VIII
IX
30
25
20
15
10
5
0
Degrees open, valve "C"
Valve "A" open 47deg.
during all runs.
Curve I = B open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
Head of fuel, column "F"
17
18
19
20
21

Fig. 1.

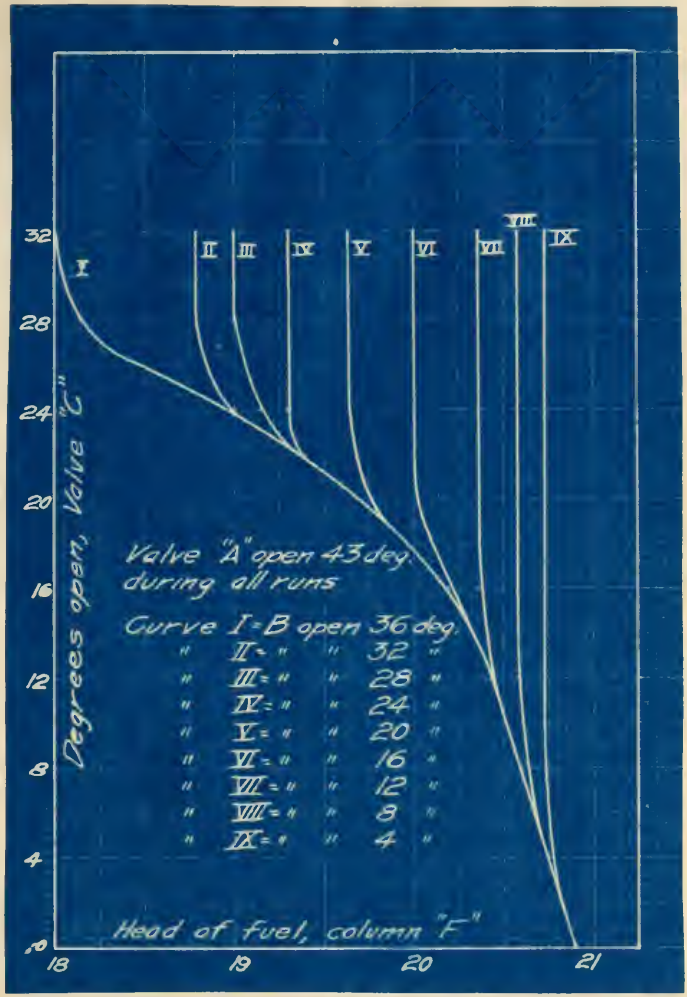

Degrees open, Valve "C"
32
28
24
20
16
12
8
4
0
18
19
20
21
I
II
III
IV
V
VI
VII
VIII
IX
Valve "A" open 43 deg.
during all runs
Curve I = B open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
Head of fuel, column "F"

Fig. 2.

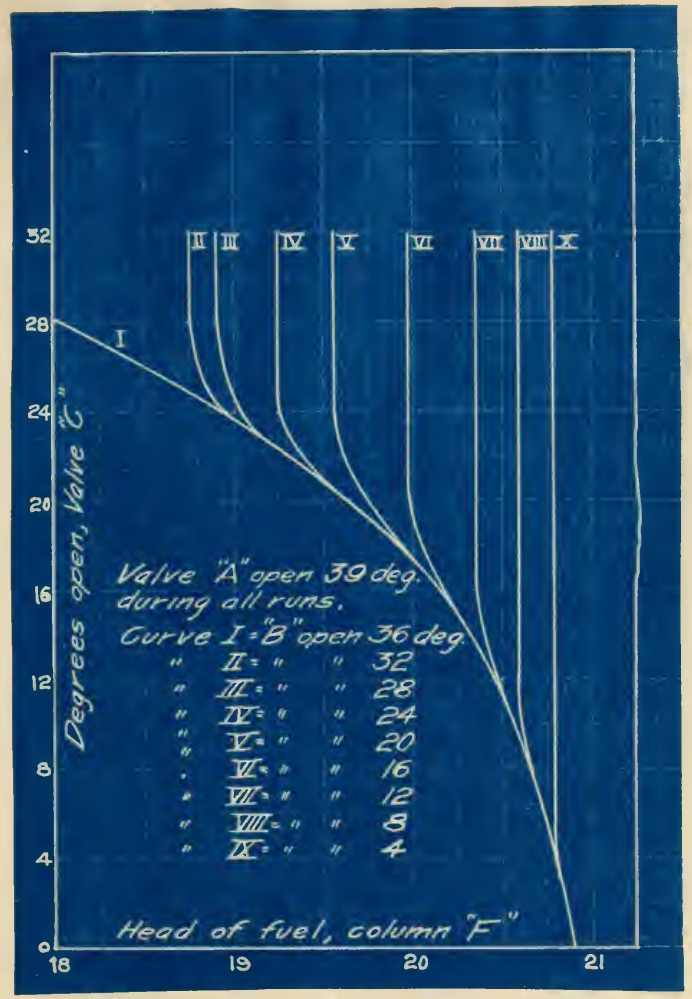

Degrees open, Valve "C"
Head of fuel, column "F"
Valve "A" open 39 deg.
during all runs.
Curve I = "B" open 36 deg.
" II = " " 32
" III = " " 28
" IV = " " 24
" V = " " 20
" VI = " " 16
" VII = " " 12
" VIII = " " 8
" IX = " " 4
I
II
III
IV
V
VI
VII
VIII
IX
0
4
8
12
16
20
24
28
32
18
19
20
21

Fig. 3.

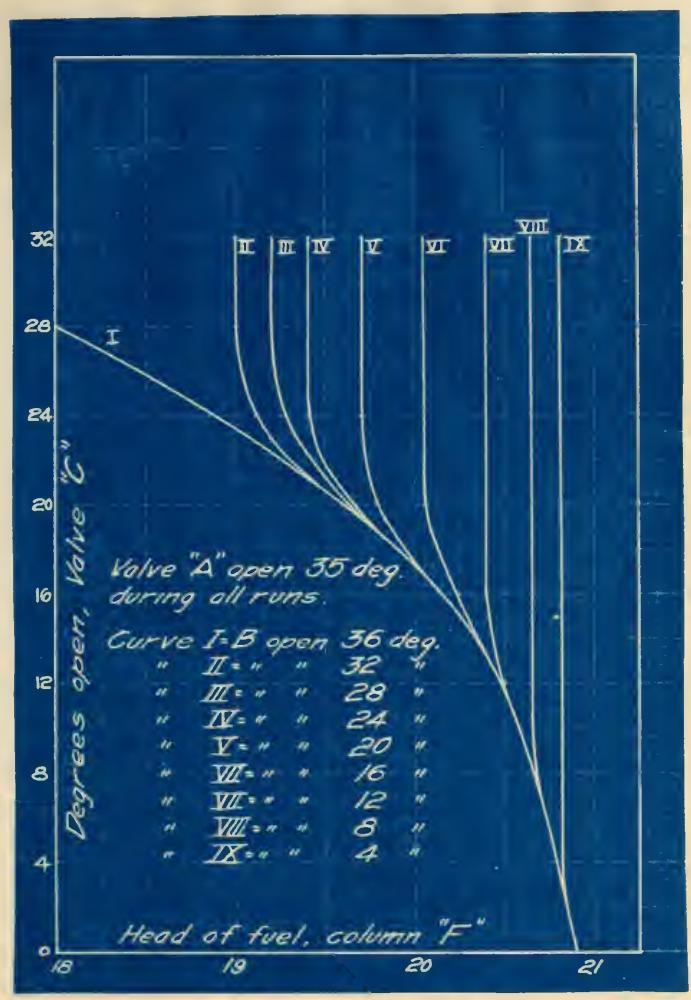

Degrees open, Valve "C"
Head of fuel, column "F"
Valve "A" open 35 deg. during all runs.
Curve I = B open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
I
II
III
IV
V
VI
VII
VIII
IX
0
4
8
12
16
20
24
28
32
18
19
20
21

Fig. 4.

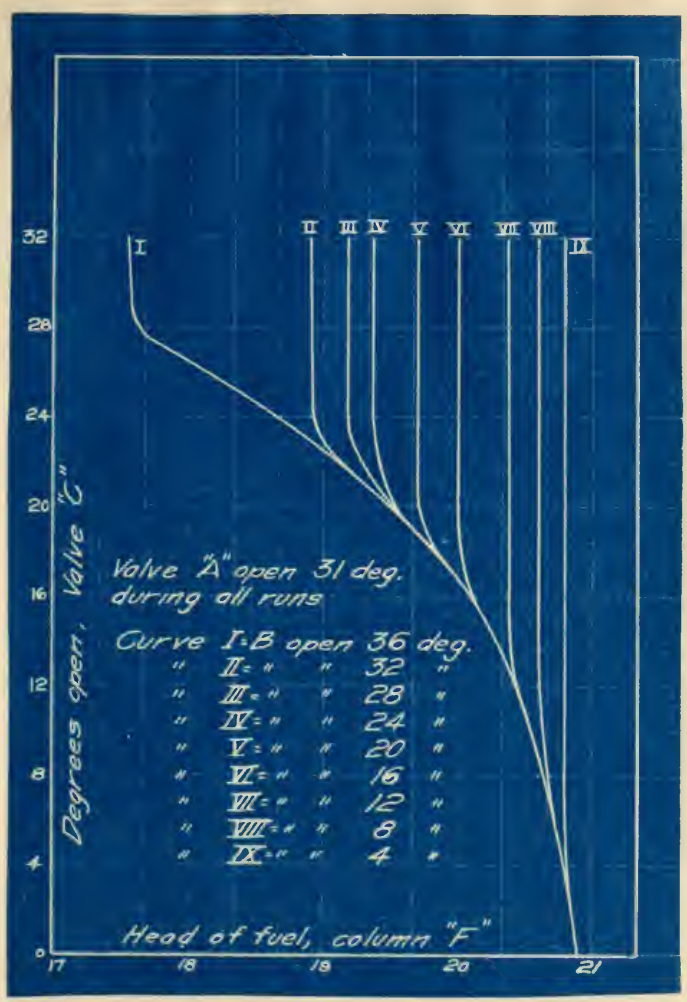

Degrees open, Valve "C"
Head of fuel, column "F"
Valve "A" open 31 deg.
during all runs
Curve I=B open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
I
II
III
IV
V
VI
VII
VIII
IX
0
4
8
12
16
20
24
28
32
17
18
19
20
21

Fig. 5.

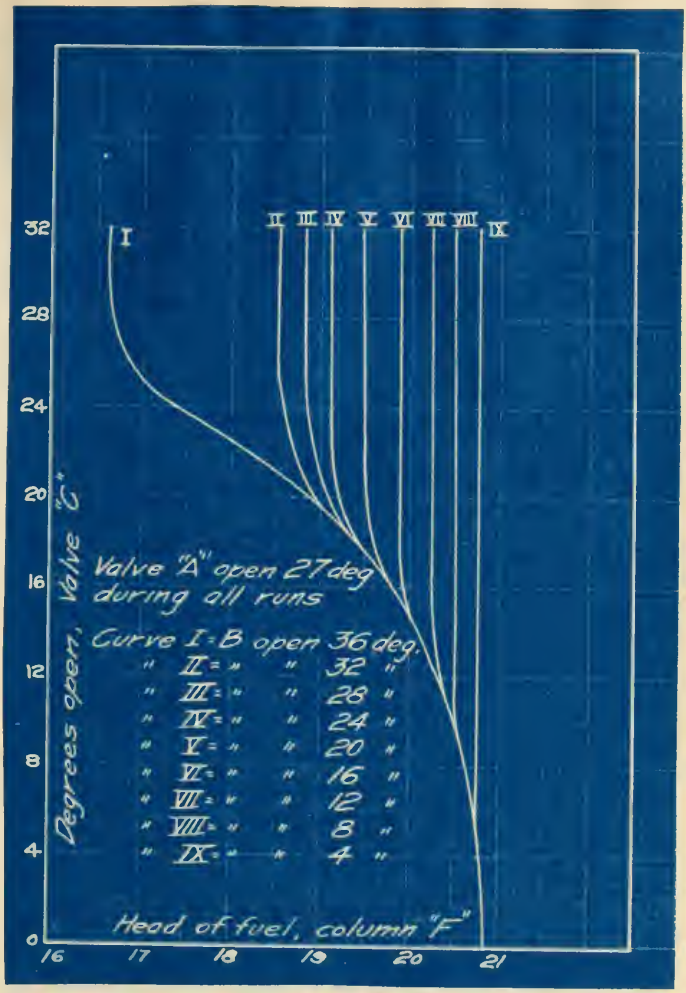

Degrees open, Valve "C"
32
28
24
20
16
12
8
4
0
I
II
III
IV
V
VI
VII
VIII
IX
Valve "A" open 27 deg
during all runs
Curve I = B open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
Head of fuel, column "F"
16
17
18
19
20
21

Fig. 6.

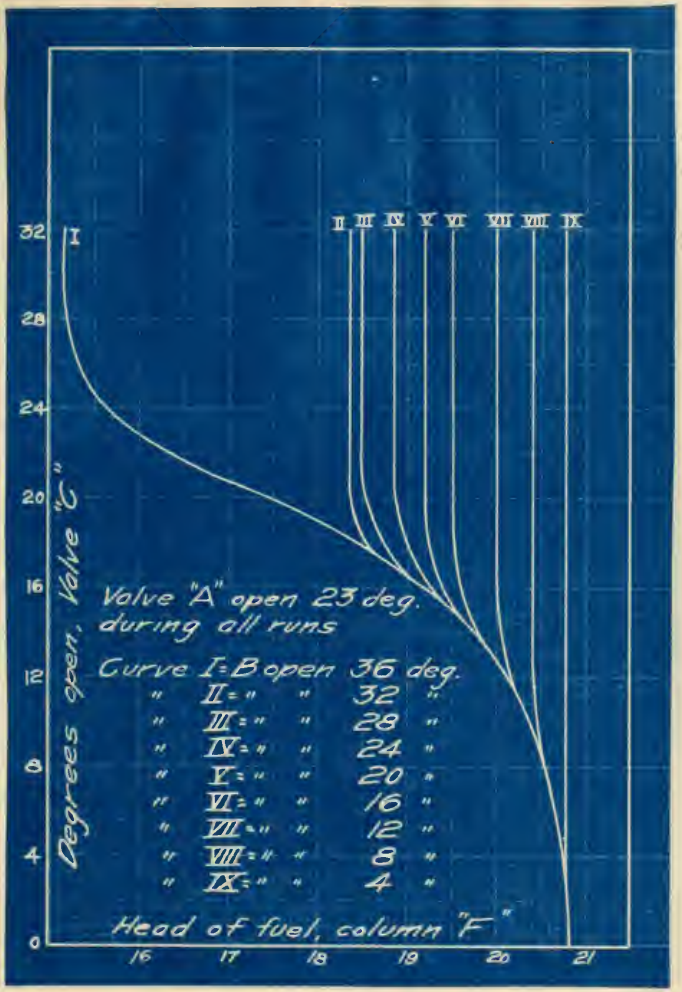

Degrees open, Valve "C"
Head of fuel, column "F"
Valve "A" open 23 deg. during all runs
Curve I = B open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
I
II
III
IV
V
VI
VII
VIII
IX
0
4
8
12
16
20
24
28
32
16
17
18
19
20
21

Fig. 7.

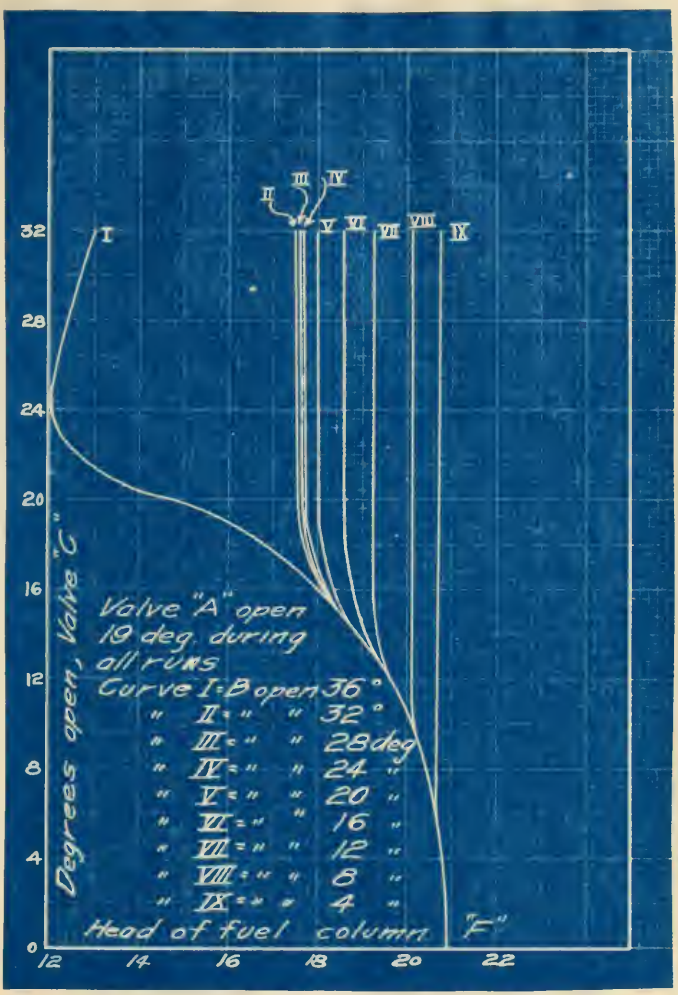

Degrees open, Valve "C"
Valve "A" open
19 deg. during
all runs
Curve I = B open 36°
" II = " " 32°
" III = " " 28 deg
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
Head of fuel column "F"
I
II
III
IV
V
VI
VII
VIII
IX
0
4
8
12
16
20
24
28
32
12
14
16
18
20
22

Fig. 8.

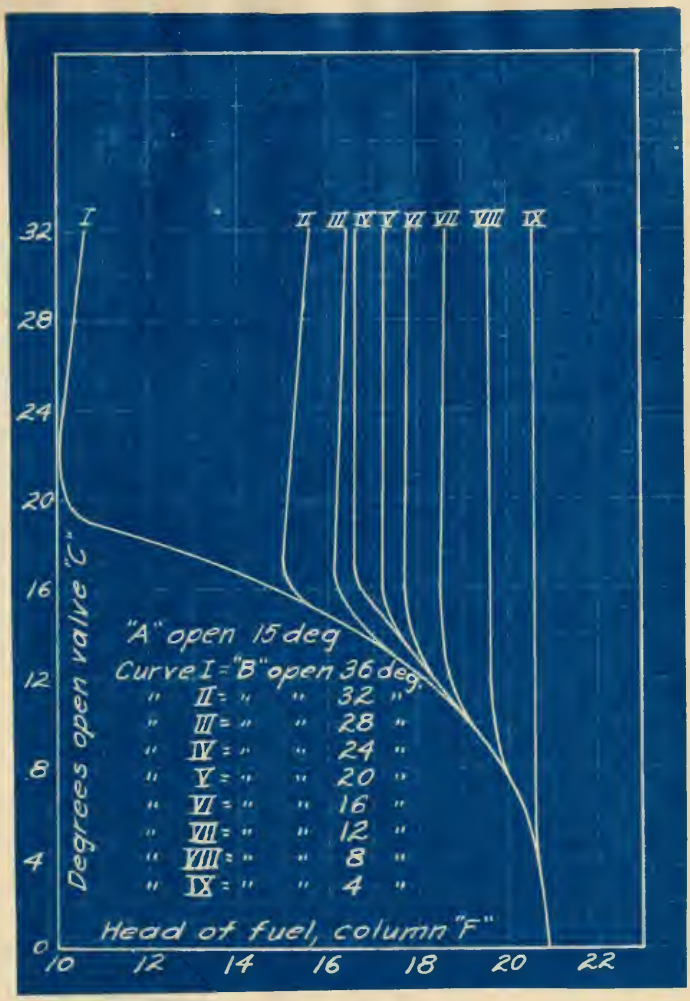

I
II
III
IV
V
VI
VII
VIII
IX
32
28
24
20
16
12
8
4
0
10
12
14
16
18
20
22
Degrees open valve "C"
Head of fuel, column "F"
"A" open 15 deg
Curve I = "B" open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "

Fig. 9.

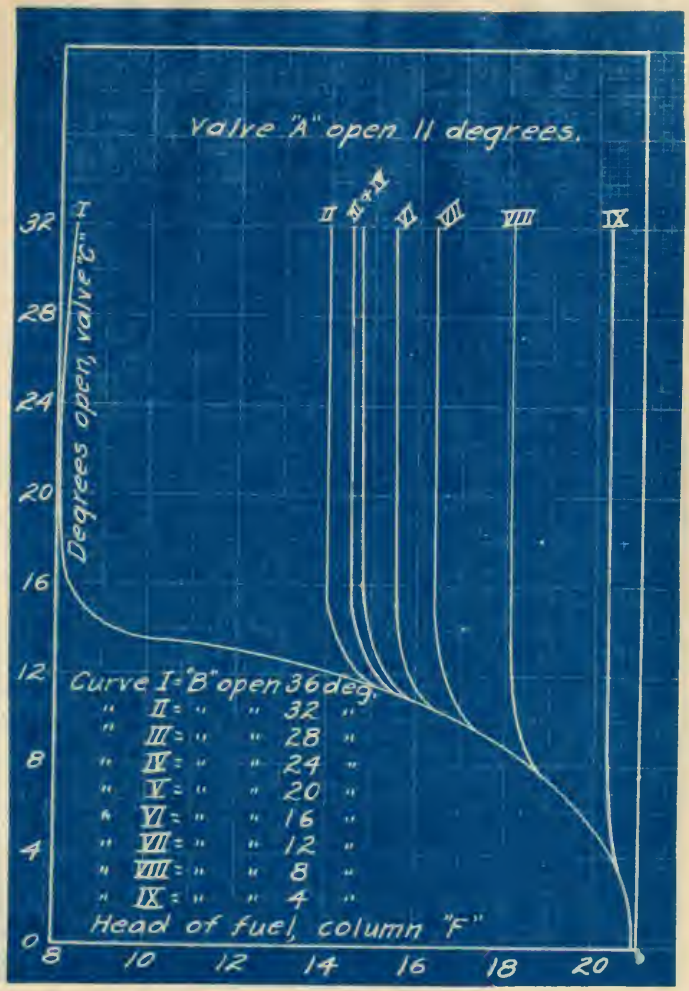

Valve "A" open 11 degrees.
Degrees open, valve "C"
Curve I = "B" open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
Head of fuel, column "F"
0
4
8
12
16
20
24
28
32
8
10
12
14
16
18
20

Fig. 10.

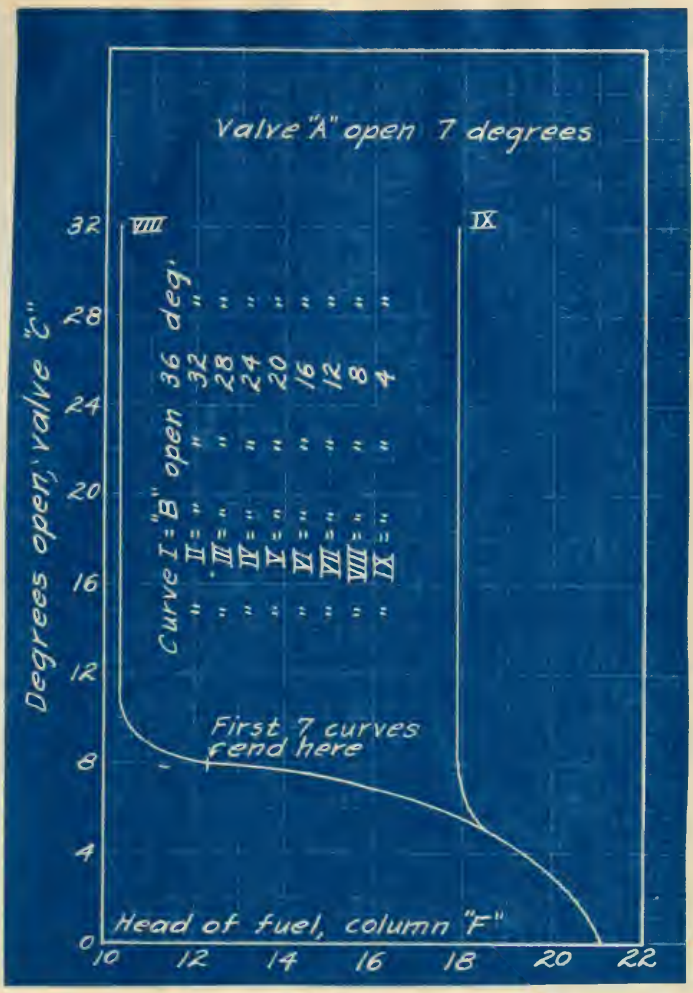

Valve "A" open 7 degrees
VIII
IX
Curve I "B" open 36 deg.
32
28
24
20
16
12
8
4
II
III
IV
V
VI
VII
VIII
IX
First 7 curves end here
Degrees open, valve "C"
Head of fuel, column "F"
0
4
8
12
16
20
24
28
32
10
12
14
16
18
20
22

Fig. 11.

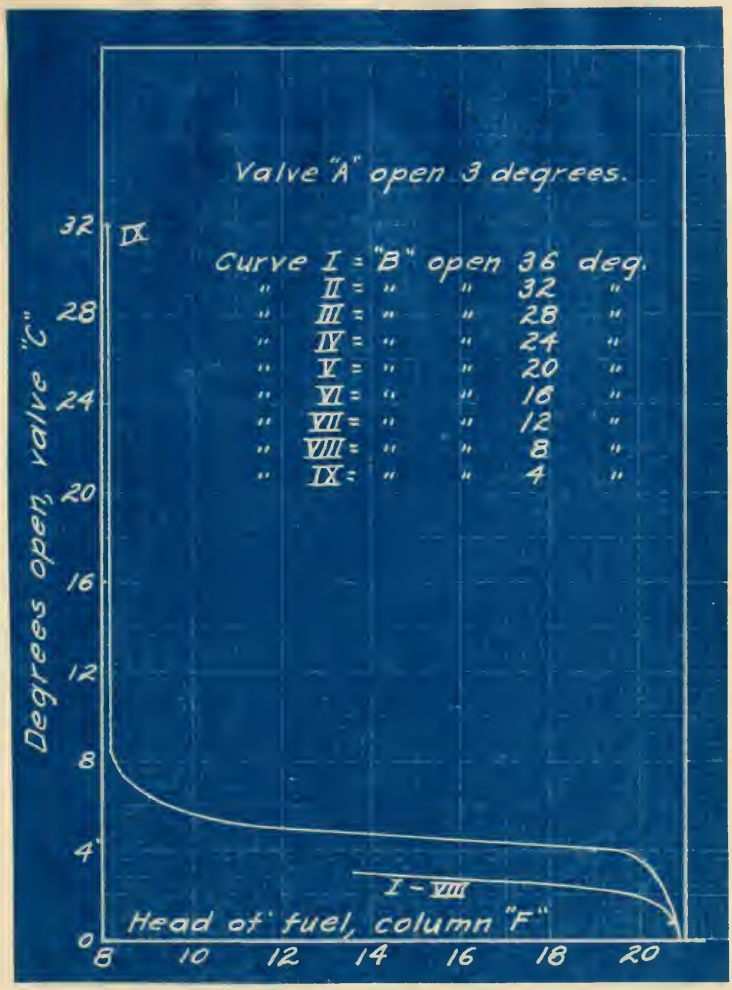

Valve "A" open 3 degrees.
Curve I = "B" open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
IX
I - VIII
Degrees open, valve "C"
Head of fuel, column "F"
0
4
8
12
16
20
24
28
32
8
10
12
14
16
18
20

Fig. 12.

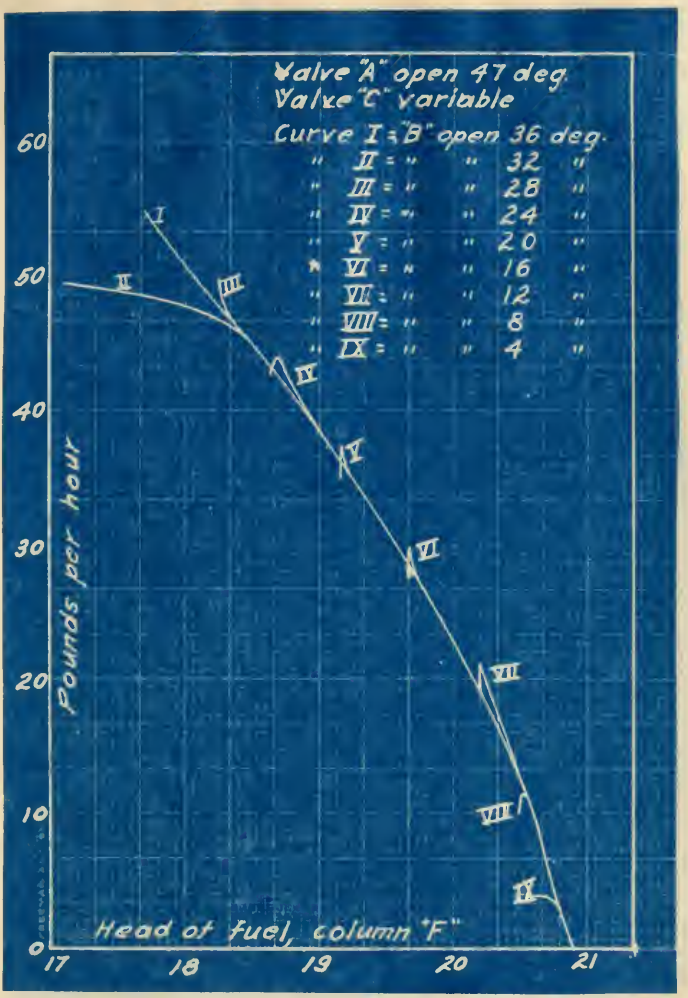

Valve "A" open 47 deg.
Valve "C" variable
Curve I = "B" open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
Pounds per hour
Head of fuel, column "F"
0
10
20
30
40
50
60
17
18
19
20
21
I
II
III
IV
V
VI
VII
VIII
IX

Fig. 13.

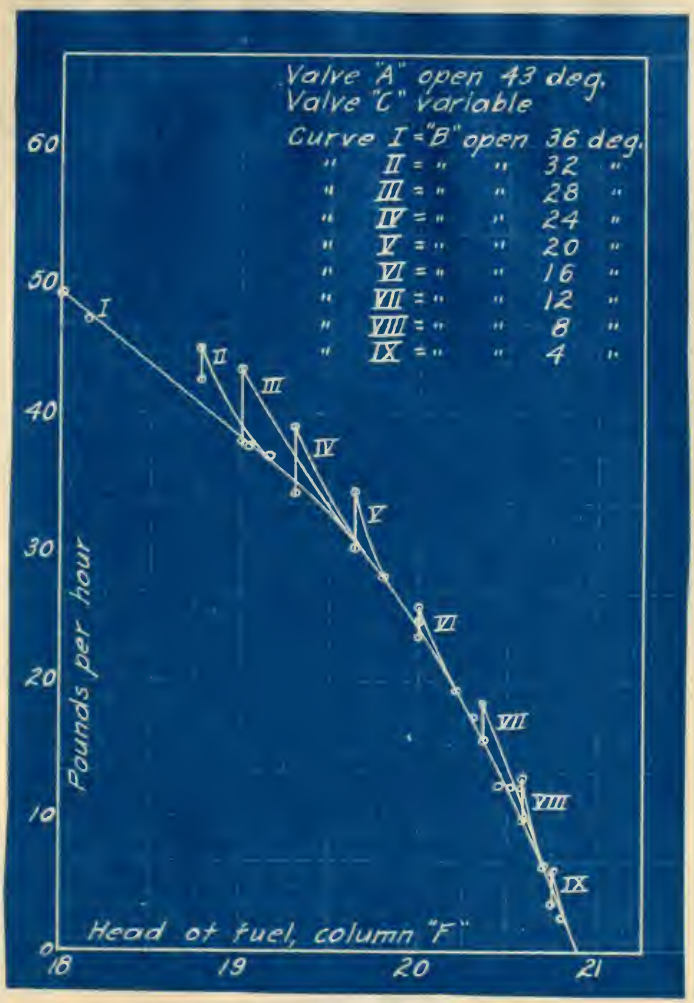

Valve "A" open 43 deg.
Valve "C" variable
Curve I = "B" open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
Pounds per hour
Head of fuel, column "F"
0
10
20
30
40
50
60
18
19
20
21
I
II
III
IV
V
VI
VII
VIII
IX

Fig. 14.

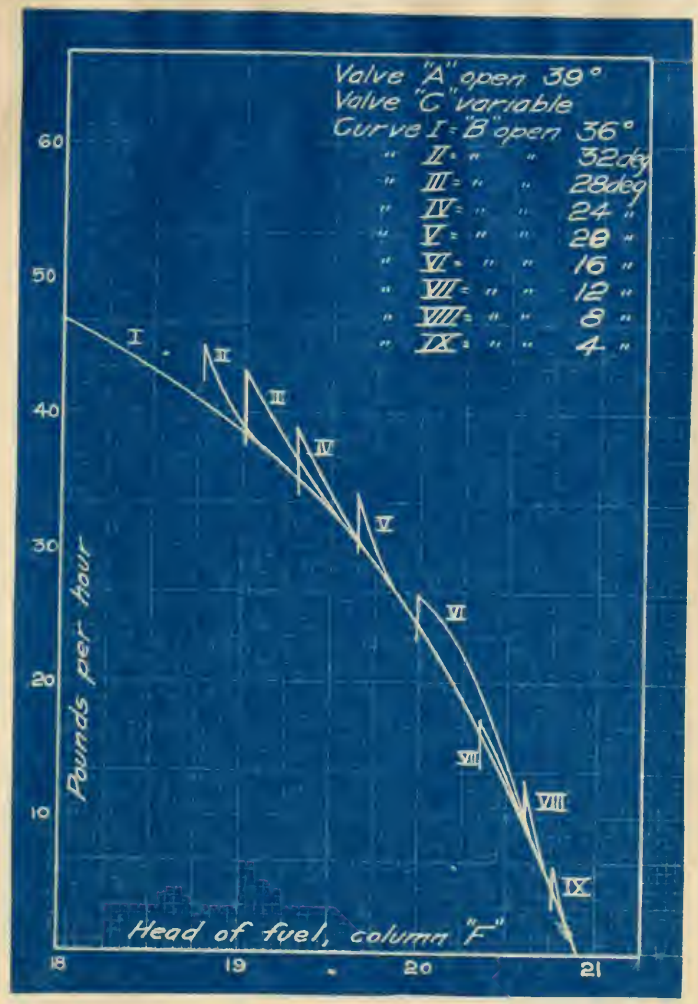

Valve "A" open 39°
Valve "C" variable
Curve I = "B" open 36°
" II = " " 32deg
" III = " " 28deg
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
Pounds per hour
Head of fuel, column "F"
60
50
40
30
20
10
18
19
20
21
I
II
III
IV
V
VI
VII
VIII
IX

Fig. 15.

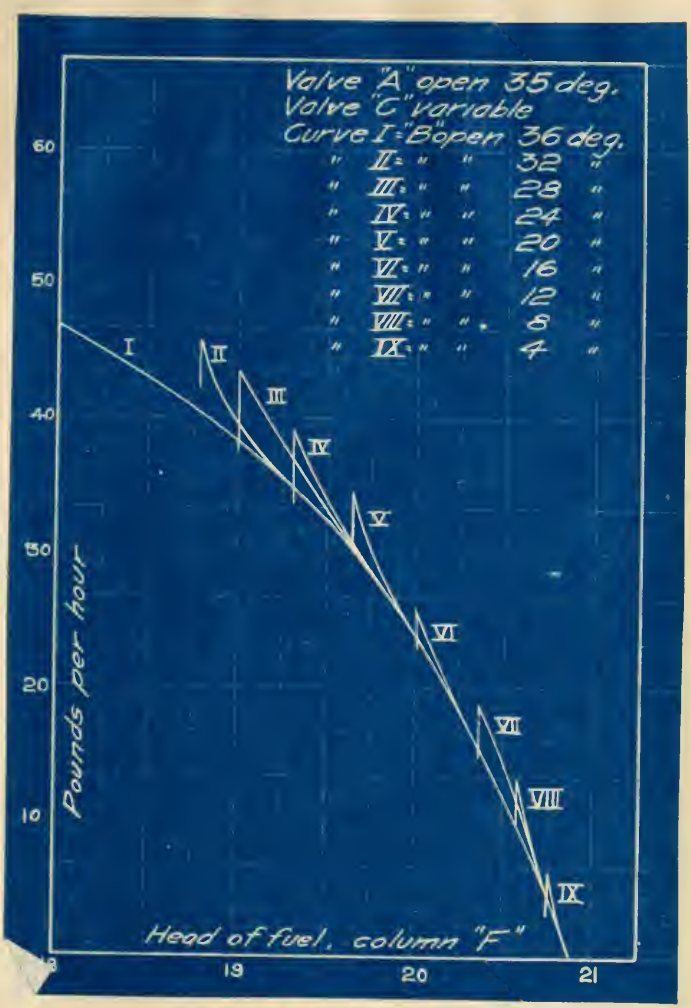

Valve "A" open 35 deg.
Valve "C" variable
Curve I = "B" open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
I
II
III
IV
V
VI
VII
VIII
IX
60
50
40
30
20
10
Pounds per hour
Head of fuel, column "F"
18
19
20
21

Fig. 16.

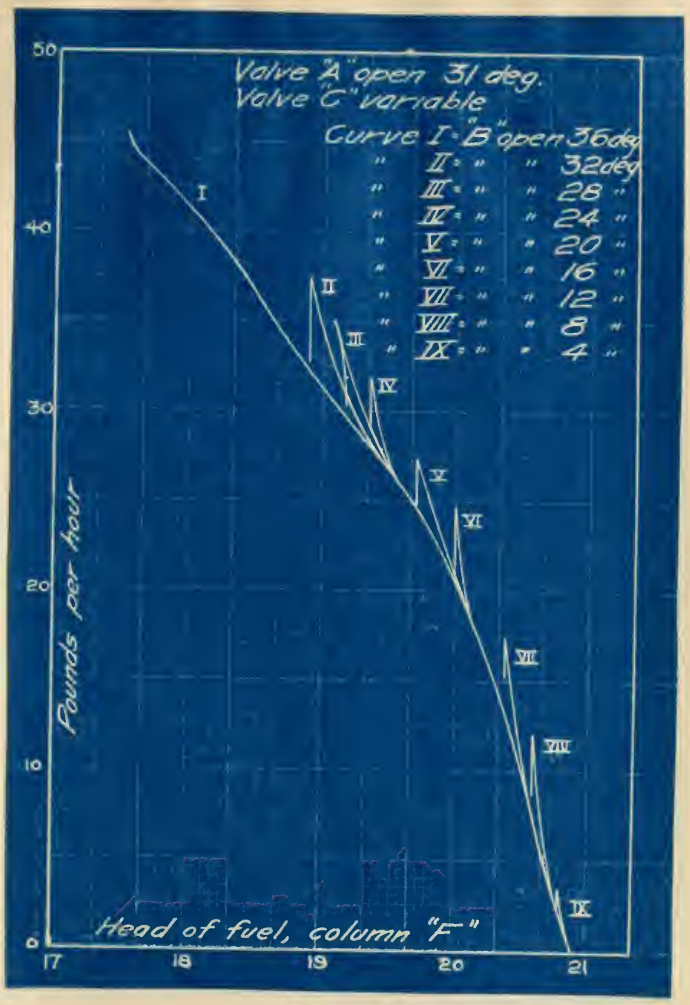

Valve "A" open 31 deg.
Valve "C" variable
Curve I - "B" open 36 deg
" II = " " 32 deg
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
Pounds per hour
Head of fuel, column "F"
0
10
20
30
40
50
17
18
19
20
21
I
II
III
IV
V
VI
VII
VIII
IX

Fig. 17.

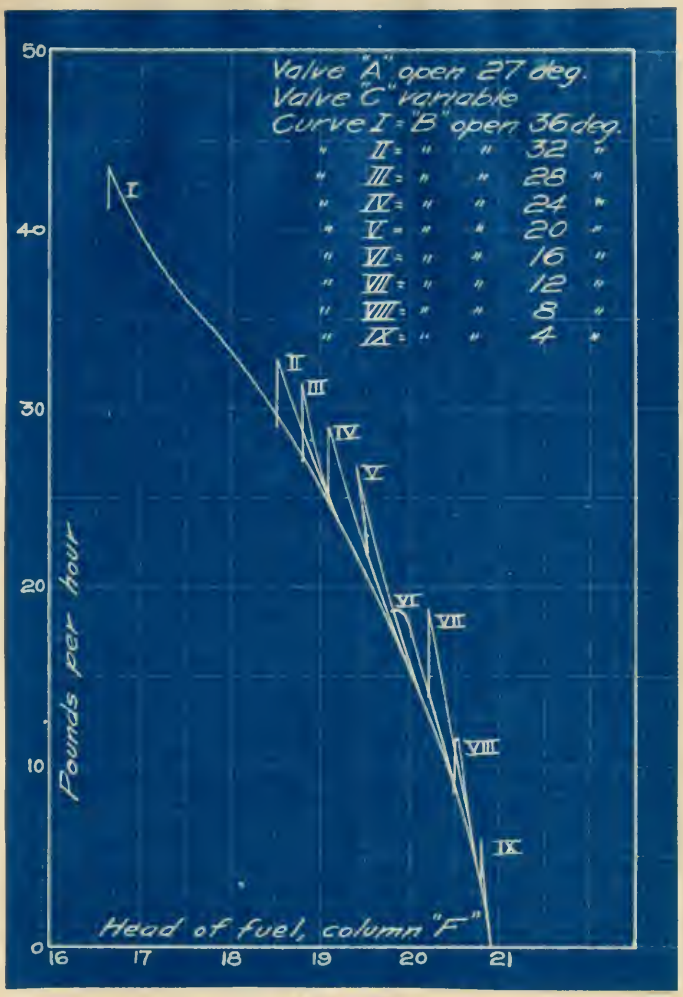

Valve "A" open 27 deg.
Valve "C" variable
Curve I = "B" open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
Pounds per hour
Head of fuel, column "F"
0
10
20
30
40
50
16
17
18
19
20
21
I
II
III
IV
V
VI
VII
VIII
IX

Fig. 18.

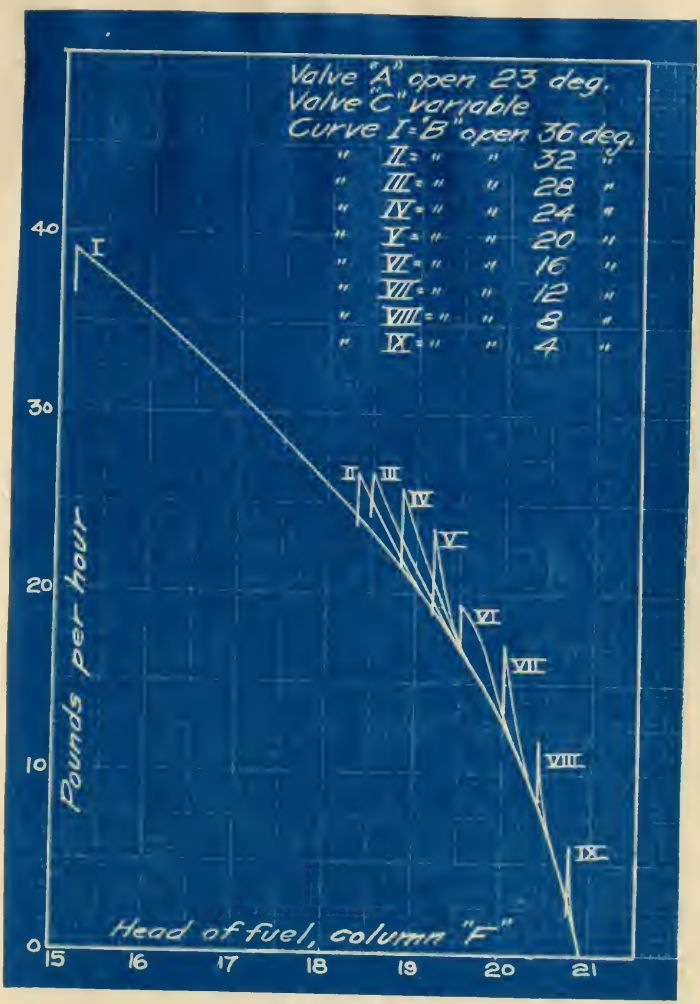

Valve "A" open 23 deg.
Valve "C" variable
Curve I = "B" open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
I
II
III
IV
V
VI
VII
VIII
IX
Pounds per hour
Head of fuel, column "F"
0
10
20
30
40
15
16
17
18
19
20
21

Fig. 19.

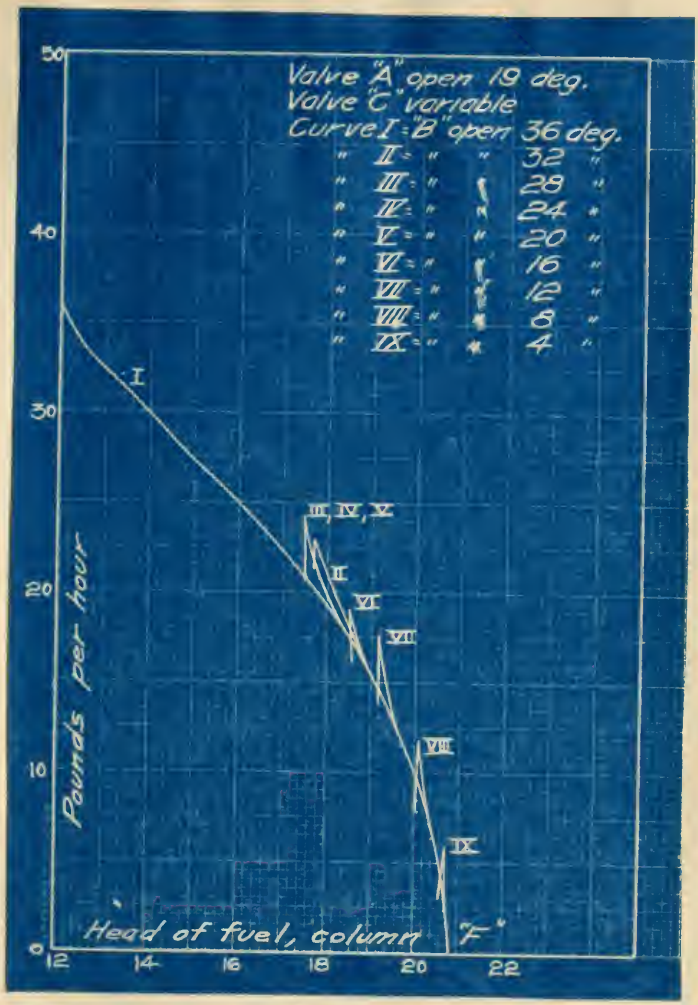

Valve "A" open 19 deg.
Valve "C" variable
Curve I = "B" open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
Pounds per hour
Head of fuel, column "F"
0
10
20
30
40
50
12
14
16
18
20
22
I
II
III, IV, V
VI
VII
VIII
IX

Fig. 20.

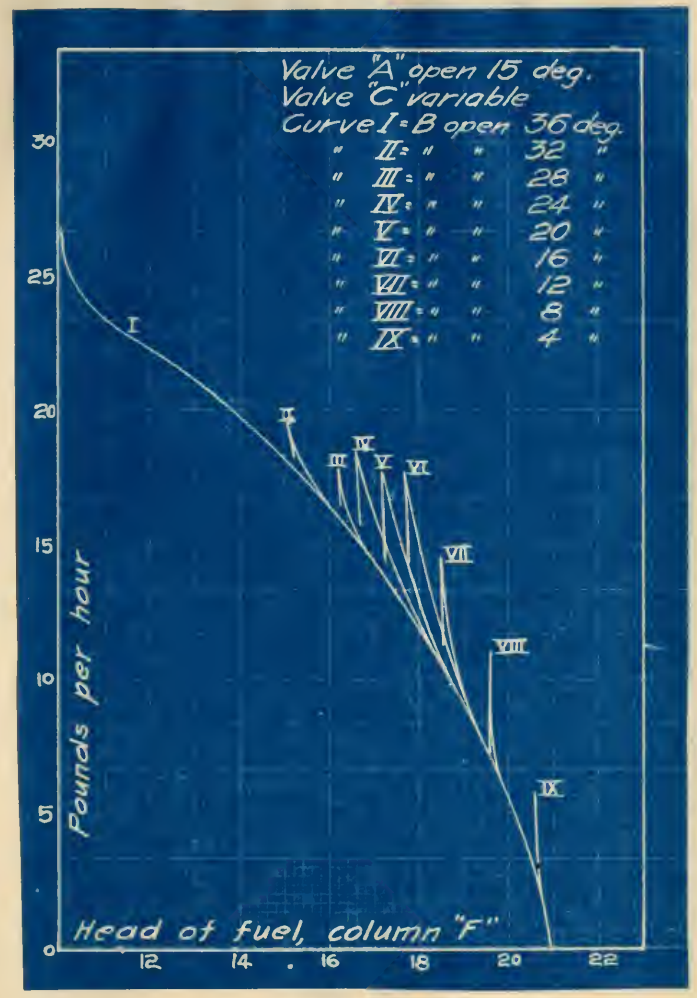

Valve "A" open 15 deg.
Valve "C" variable
Curve I = B open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
Pounds per hour
Head of fuel, column "F"
0
5
10
15
20
25
30
12
14
16
18
20
22
I
II
III
IV
V
VI
VII
VIII
IX

Fig. 21.

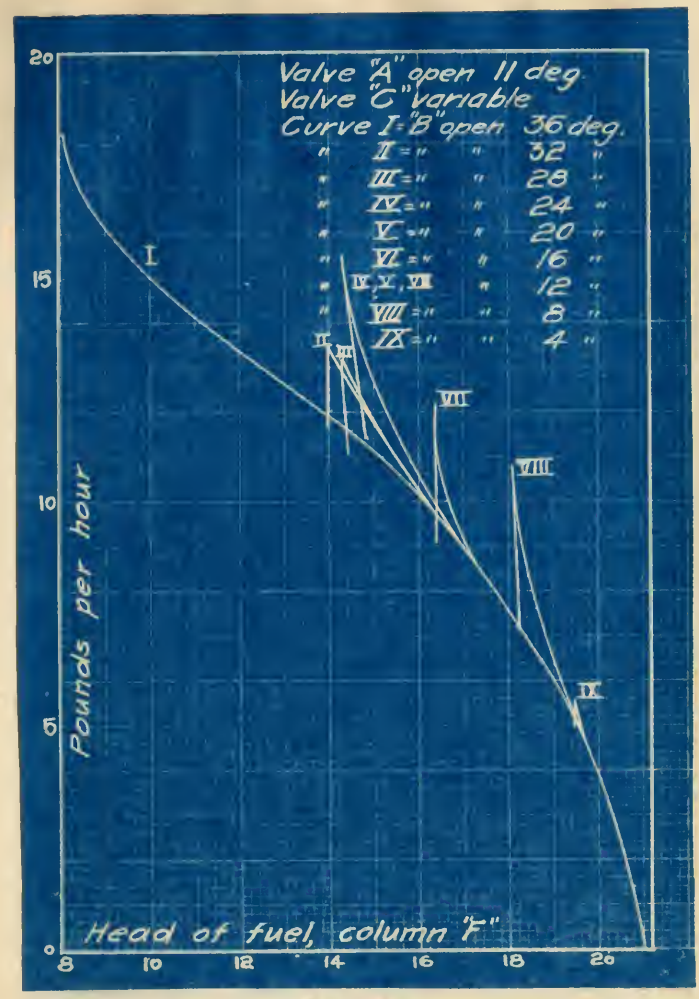

Valve "A" open 11 deg.
Valve "C" variable
Curve I = "B" open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" IV, V, VI " 12 "
" VII = " " 8 "
" IX = " " 4 "
I
II
III
VII
VIII
IX
Pounds per hour
Head of fuel, column "F"
0
5
10
15
20
8
10
12
14
16
18
20

Fig. 22.

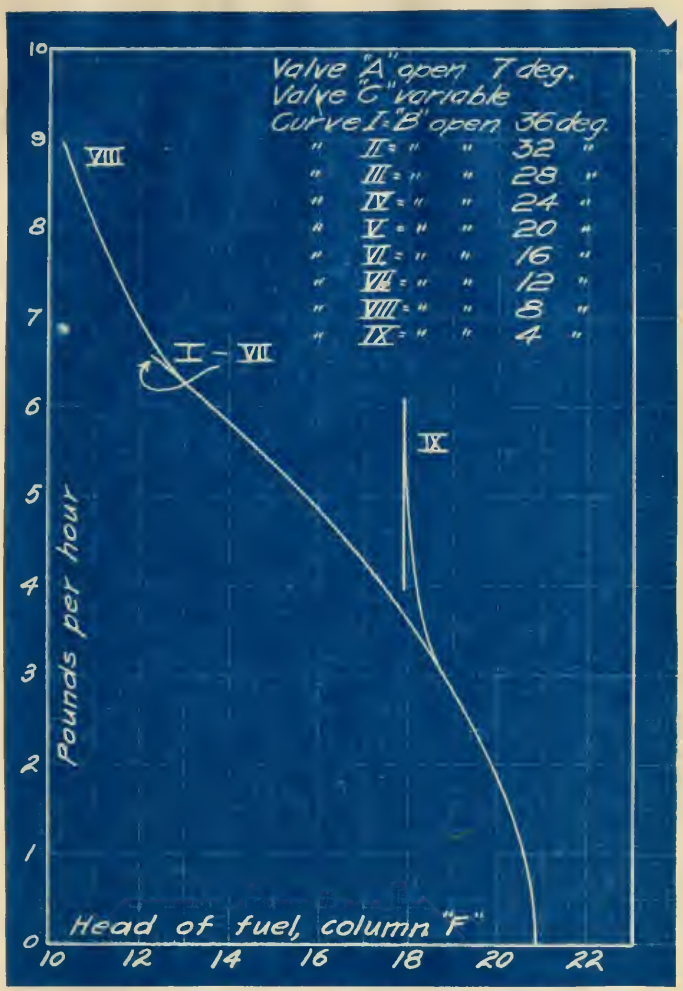

Valve "A" open 7 deg.
Valve "C" variable
Curve I "B" open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
VIII
I - VII
IX
Pounds per hour
Head of fuel, column "F"
0
1
2
3
4
5
6
7
8
9
10
10
12
14
16
18
20
22

Fig. 23.

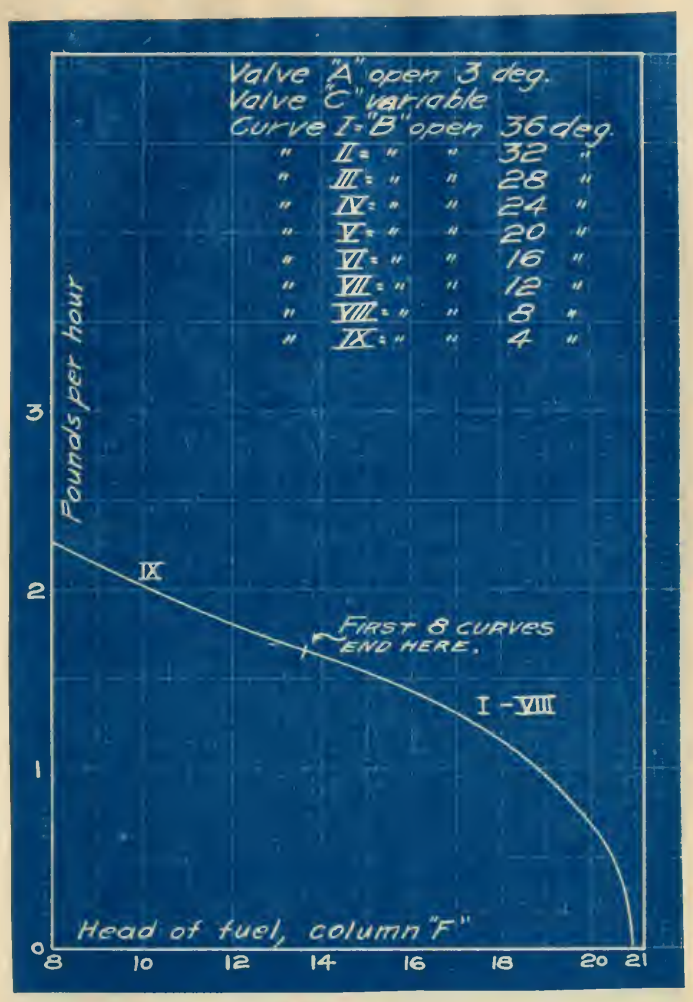

Valve "A" open 3 deg.
Valve "C" variable
Curve I = "B" open 36 deg.
" II = " " 32 "
" III = " " 28 "
" IV = " " 24 "
" V = " " 20 "
" VI = " " 16 "
" VII = " " 12 "
" VIII = " " 8 "
" IX = " " 4 "
Pounds per hour
3
2
1
0
IX
FIRST 8 CURVES END HERE.
I - VIII
Head of fuel, column "F"
8
10
12
14
16
18
20
21

Fig. 24.

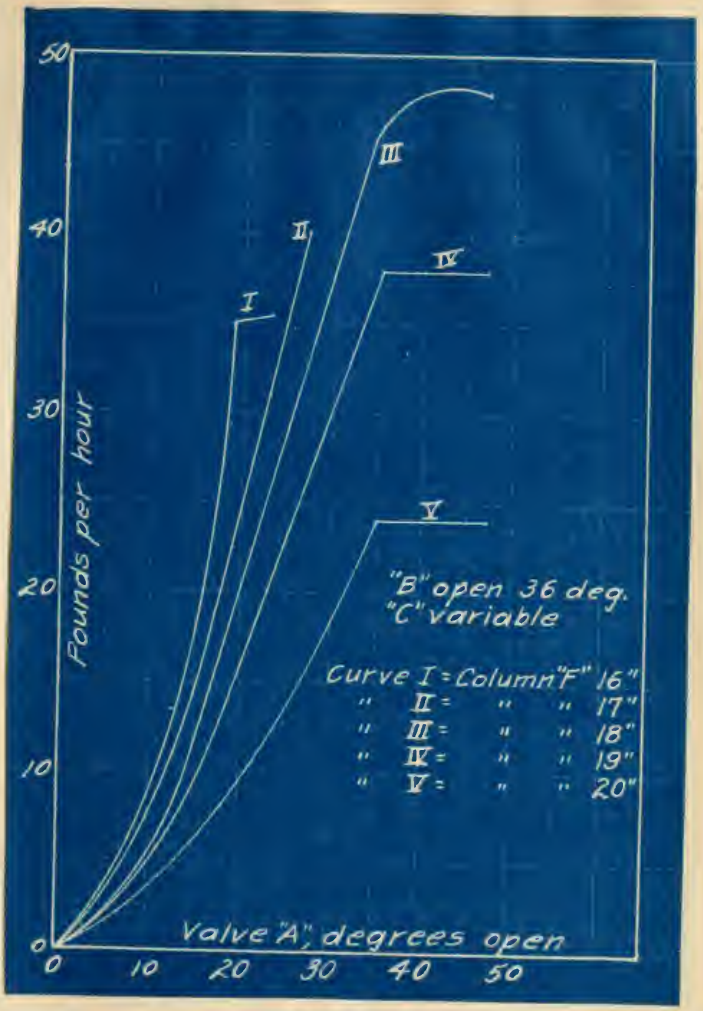

50
40
30
20
10
0
Pounds per hour
I
II
III
IV
V
"B" open 36 deg.
"C" variable
Curve I = Column "F" 16"
" II = " " 17"
" III = " " 18"
" IV = " " 19"
" V = " " 20"
Valve "A", degrees open
0
10
20
30
40
50

Fig. 25.

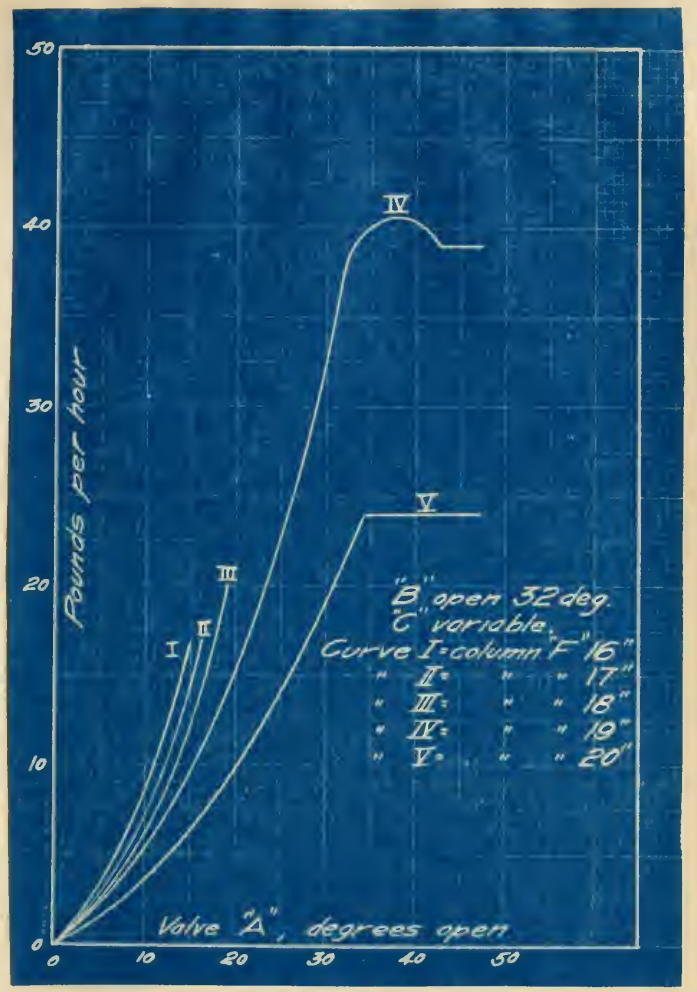

Pounds per hour
Valve "A", degrees open
0
10
20
30
40
50
I
II
III
IV
V
"B" open 32 deg.
"C" variable.
Curve I = column "F" 16"
" II = " " 17"
" III = " " 18"
" IV = " " 19"
" V = " " 20"

Fig. 26.

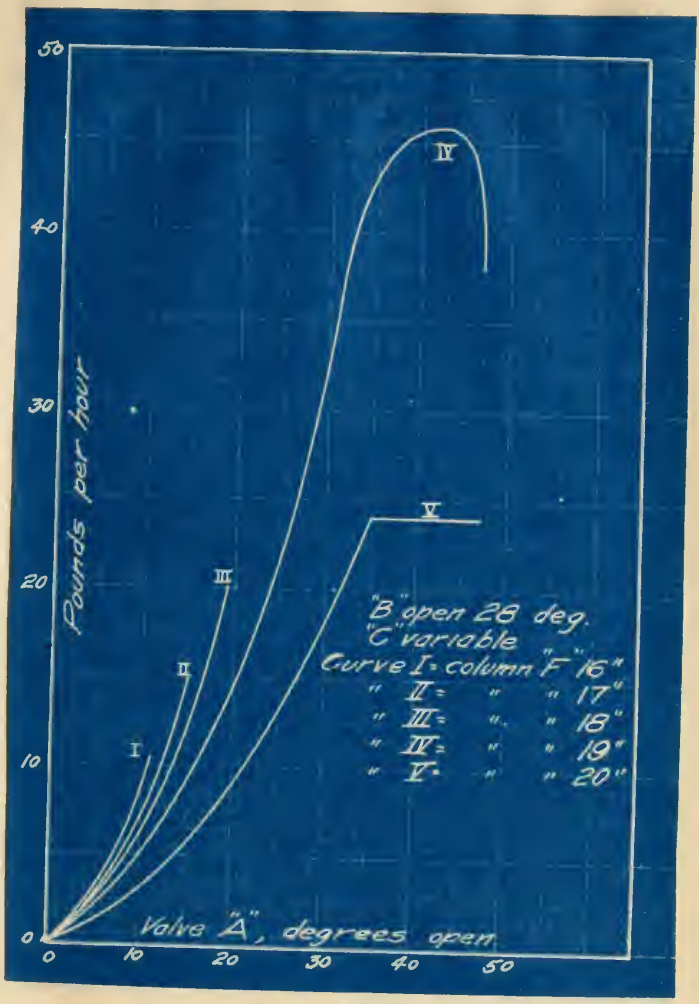

Pounds per hour
Valve "A", degrees open
"B" open 28 deg.
"C" variable
Curve I = column "F" 16"
" II = " " 17"
" III = " " 18"
" IV = " " 19"
" V = " " 20"
I
II
III
IV
V
0
10
20
30
40
50

Fig. 27.

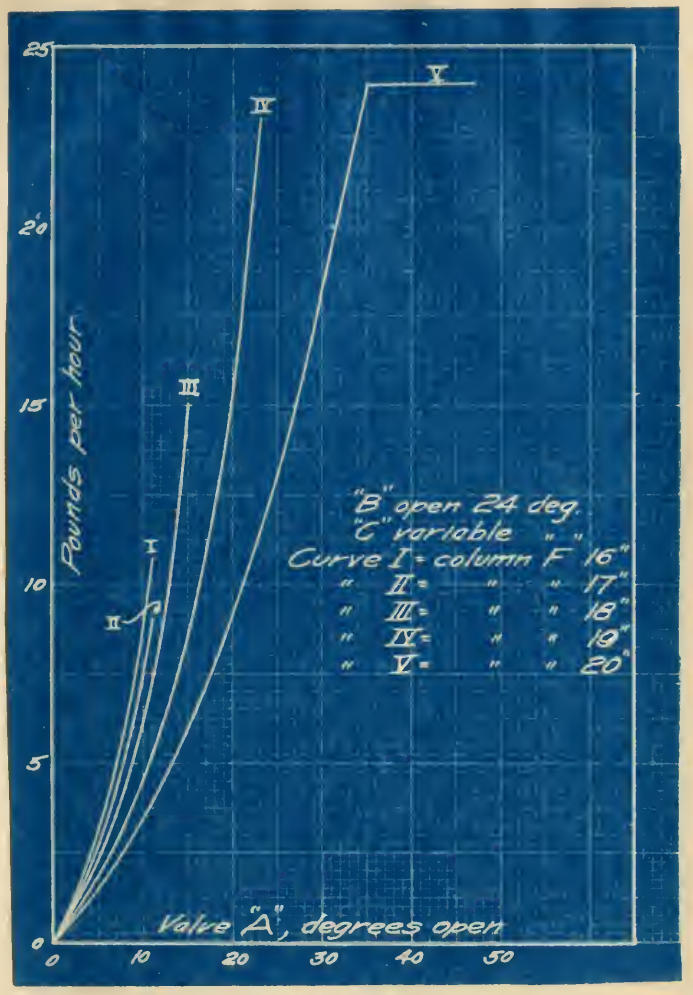

25
20
15
10
5
0
Pounds per hour
0
10
20
30
40
50
Valve "A", degrees open
I
II
III
IV
V
"B" open 24 deg.
"C" variable " "
Curve I = column F 16"
" II = " " 17"
" III = " " 18"
" IV = " " 19"
" V = " " 20"

Fig. 28.

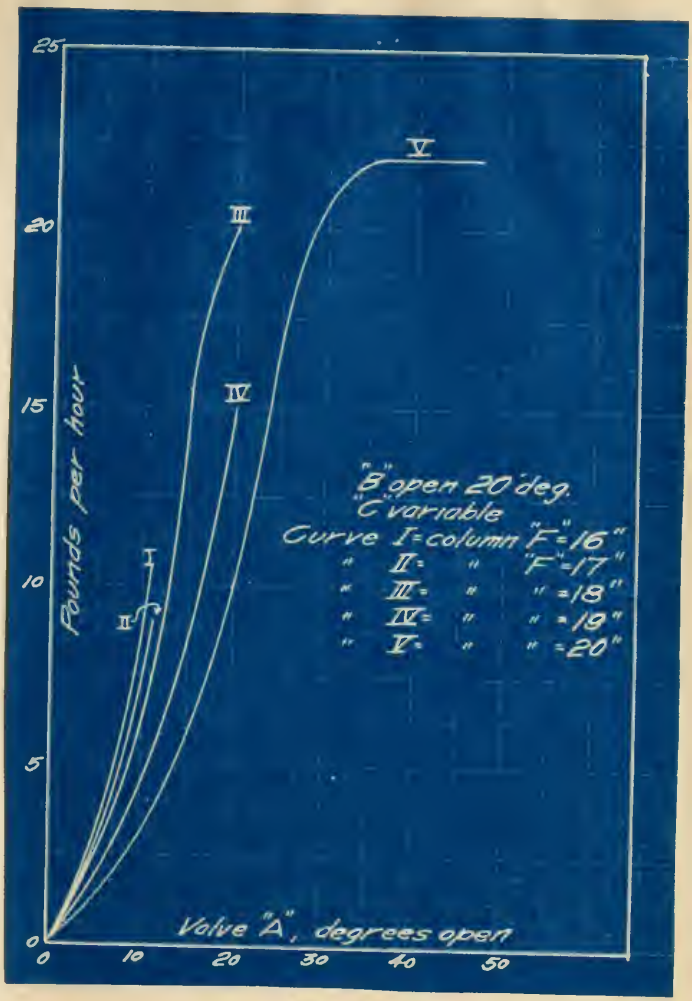

25
20
15
10
5
0
Pounds per hour
0
10
20
30
40
50
Valve "A", degrees open
I
II
III
IV
V
"B" open 20 deg.
"C" variable
Curve I = column "F" = 16"
" II = " "F" = 17"
" III = " " = 18"
" IV = " " = 19"
" V = " " = 20"

Fig. 29.

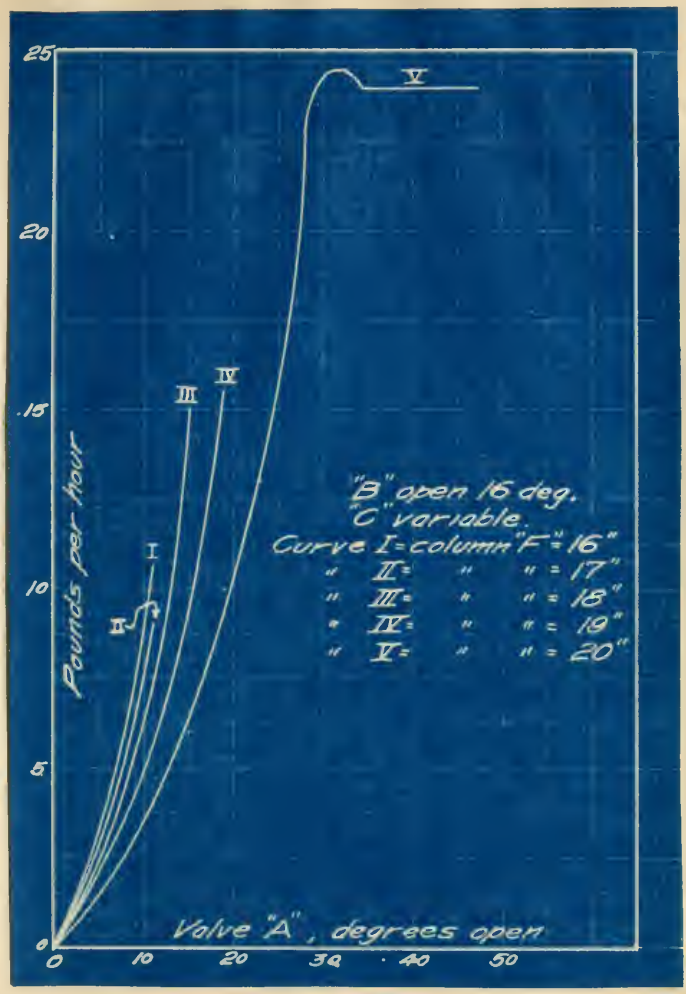

25
20
15
10
5
0
Pounds per hour
0
10
20
30
40
50
Valve "A", degrees open
I
II
III
IV
V
"B" open 16 deg.
"C" variable.
Curve I = column "F" = 16"
" II = " " = 17"
" III = " " = 18"
" IV = " " = 19"
" V = " " = 20"

Fig. 30.

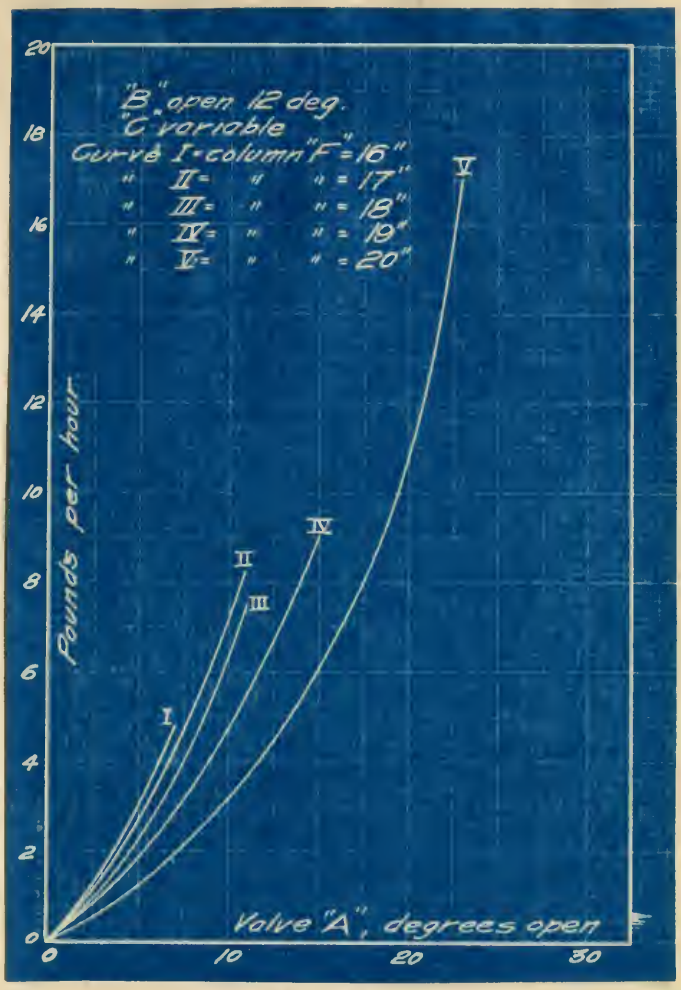

"B" open 12 deg.
"C" variable
Curve I = column "F" = 16"
" II = " " = 17"
" III = " " = 18"
" IV = " " = 19"
" V = " " = 20"
Pounds per hour.
Valve "A", degrees open
0
2
4
6
8
10
12
14
16
18
20
0
10
20
30
I
II
III
IV
V

Fig. 31.

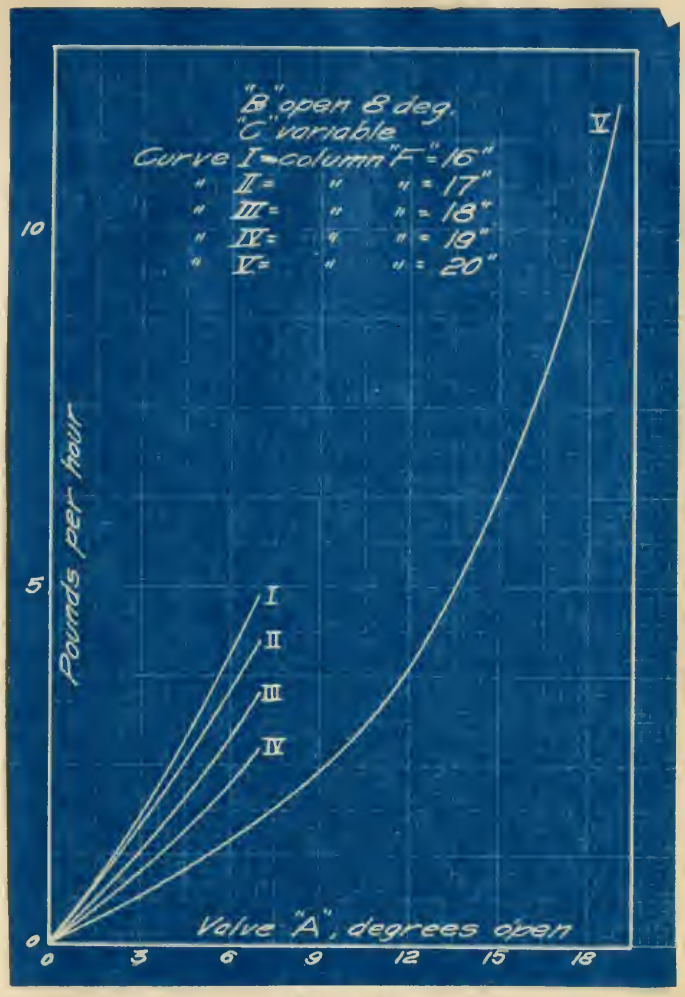

"B" open 8 deg.
"C" variable
Curve I = column "F" = 16"
" II = " " = 17"
" III = " " = 18"
" IV = " " = 19"
" V = " " = 20"
V
I
II
III
IV
Pounds per hour
Valve "A", degrees open
0
5
10
0
3
6
9
12
15
18

Fig. 32.

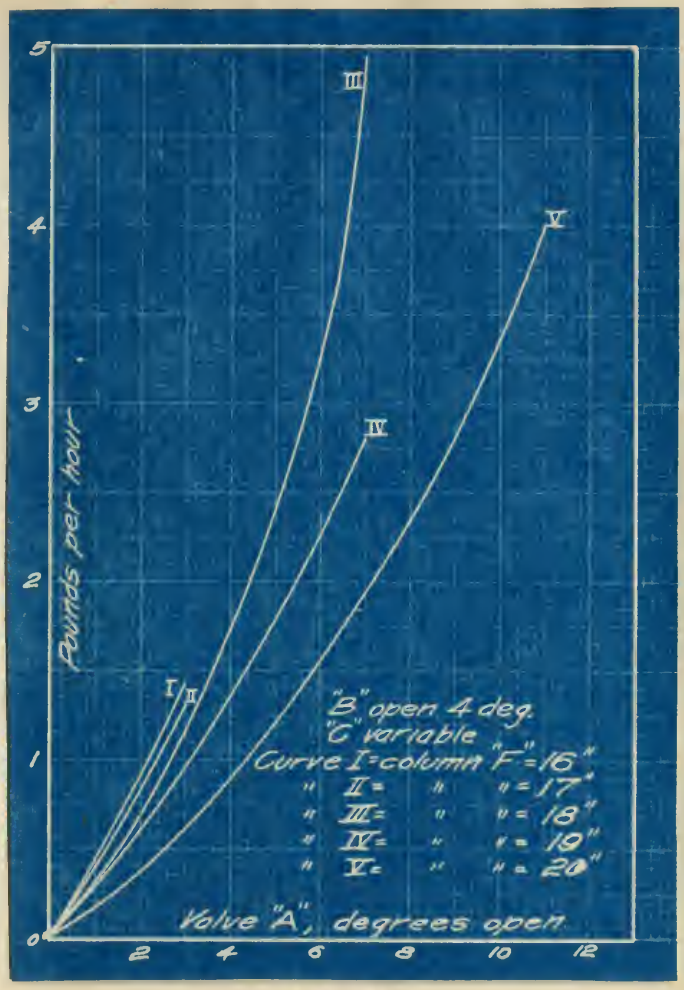

Pounds per hour
Valve "A", degrees open
"B" open 4 deg.
"C" variable
Curve I = column "F" = 16"
" II = " " = 17"
" III = " " = 18"
" IV = " " = 19"
" V = " " = 20"
I
II
III
IV
V
0
1
2
3
4
5
2
4
6
8
10
12

Fig. 33.

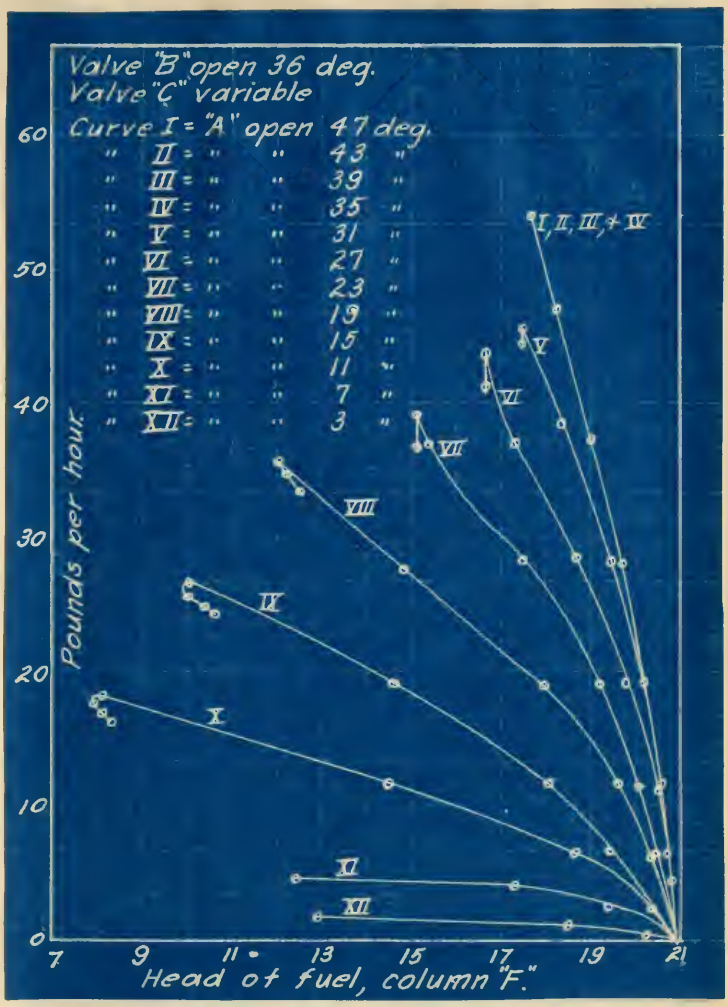

Valve "B" open 36 deg.
Valve "C" variable
Curve I = "A" open 47 deg.
" II = " " 43 "
" III = " " 39 "
" IV = " " 35 "
" V = " " 31 "
" VI = " " 27 "
" VII = " " 23 "
" VIII = " " 19 "
" IX = " " 15 "
" X = " " 11 "
" XI = " " 7 "
" XII = " " 3 "
I, II, III, + IV
V
VI
VII
VIII
IX
X
XI
XII
Pounds per hour.
0
10
20
30
40
50
60
7
9
11
13
15
17
19
21
Head of fuel, column "F."

Fig. 34.

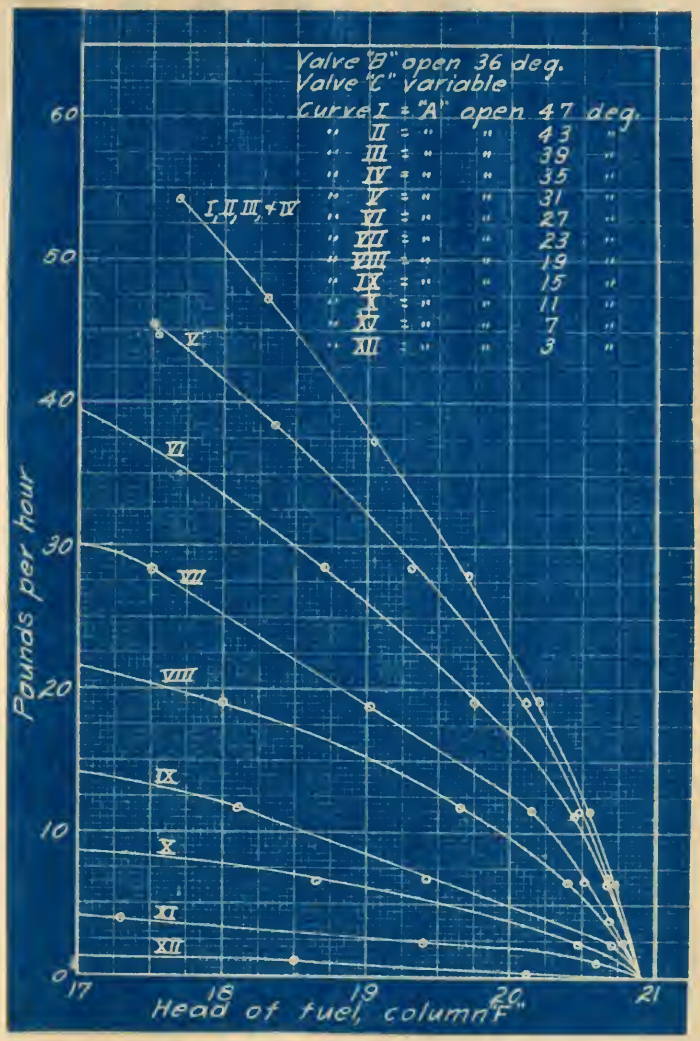
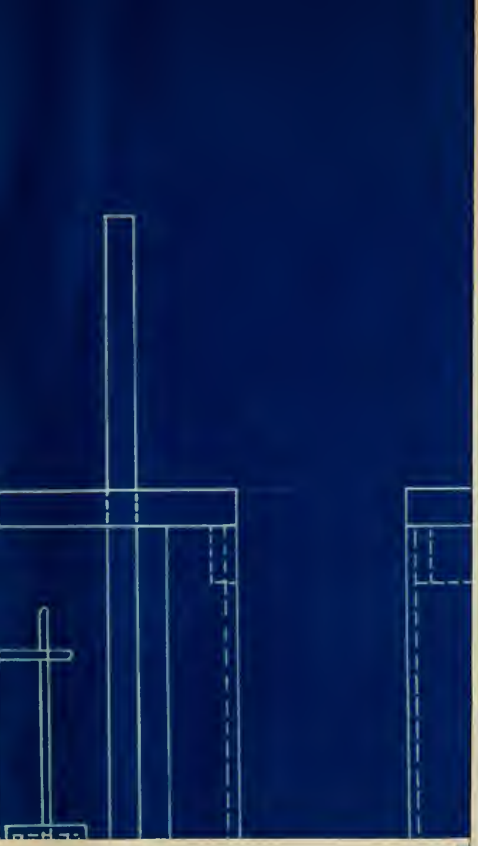

Valve "B" open 36 deg.
Valve "C" variable
Curve I = "A" open 47 deg.
" II = " " 43 "
" III = " " 39 "
" IV = " " 35 "
" V = " " 31 "
" VI = " " 27 "
" VII = " " 23 "
" VIII = " " 19 "
" IX = " " 15 "
" X = " " 11 "
" XI = " " 7 "
" XII = " " 3 "
I, II, III, + IV
V
VI
VII
VIII
IX
X
XI
XII
Pounds per hour
0
10
20
30
40
50
60
17
18
19
20
21
Head of fuel, column F"

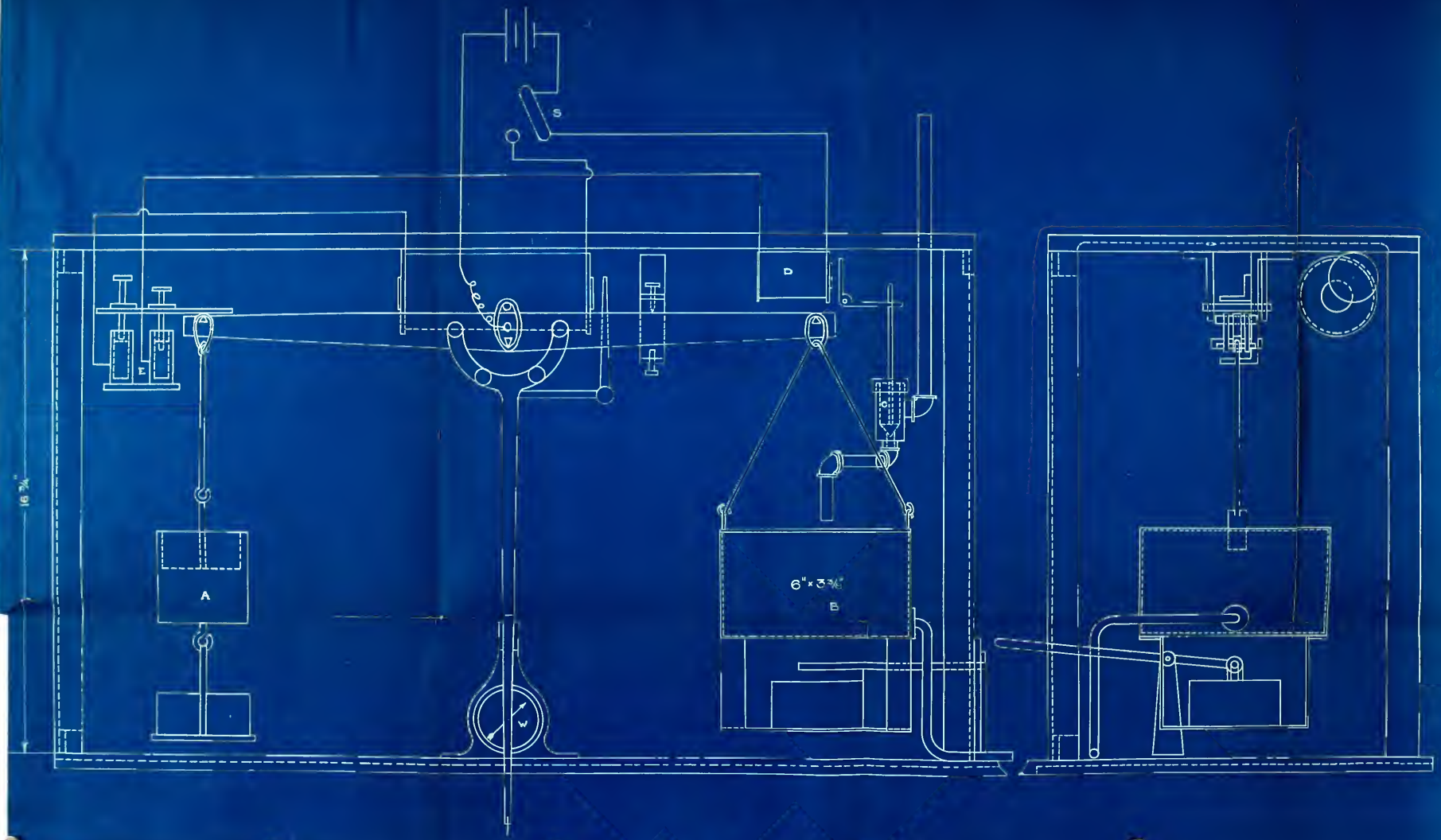
Fig. 35.

PART Vll.

Conclusion.

The preceeding data and curves show that and apparatus such as was used, can be used succesfully in determing the amount of oil which an engine is using at any instant, by referring to the proper curve as shown in Part VI..




S
D
E
A
6"x3¾"
B
W
16¾"